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Holistic Management of Diabetic Ulcer in Construction Worker with Low-Risk Neuropathy Symptoms Score and Proximal Phalanx Diggiti III-IV Pedis Dextra Amputation History

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ABSTRACT: Diabetic ulcers are the most common complication of uncontrolled Diabetes Mellitus (DM), characterized by high blood glucose levels that lead to complications such as neuropathy (motor, sensory, autonomic) and vascular abnormalities, making infections more likely. According to research in Indonesia, the incidence of diabetic ulcers ranges from 15-25% of the total number of diabetes mellitus patients, with an annual prevalence of 2% to 5-7.5% in patients with neuropathy. Application of evidence-based medicine-based family doctor services to patients by identifying risk factors, clinical problems, and patient management based on a patient-centered and family problem-solving framework. This case report taken by primary data through auto-anamnesis, physical examination and home visits. Secondary data was obtained from the patient's medical record. The assessment is based on a holistic diagnosis from entire of the study qualitatively and quantitatively. Patient Mr. E, 61 years old has internal factor risks such as elderly age, curative treatment patterns, inappropriate eating habits, lack of knowledge about the disease which, and external risk factors in the form of curative family treatment patterns and lack of family support related to patient's disease. Patient's management is holistic and comprehensive, patient-centered, family approach, and community-based in the literature based on EBM. Patient was intervened with media posters about DM, diet, proper diabetic ulcer care and educating families to support patients. Results of the intervention evaluation are increase in patient and family's knowledge, controlled blood sugar, and eating behavior according to Adequacy of Nutrition Level.

KEYWORDS: Family Medicine Services, Holistic Management, Type 2 Diabetes Melitus.

INTRODUCTION

Diabetic ulcers are the most common complication in uncontrolled Diabetes Mellitus (DM), characterized by elevated blood glucose levels that lead to complications such as neuropathy (motor, sensory, autonomic) and vascular abnormalities, making infections more likely. This complication significantly affects an individual's quality of life and productivity. [1]

Chronic complications of DM can be categorized into macrovascular and microvascular disorders. Macrovascular complications in diabetic patients include three main conditions: coronary artery disease (CAD), cerebrovascular disease, and peripheral vascular disease (PVD). Microvascular complications include retinopathy, nephropathy, and neuropathy. These complications arise due to persistent hyperglycemia and the formation of glycated proteins (such as HbA1c), which weaken blood vessels, making them fragile and eventually leading to obstructions in small blood vessels.[2],[3]

The onset of ulcers in diabetic patients often begins with infections that progress into diabetic ulcers. The most common bacterial infection is caused by *Staphylococcus aureus*, with predilection sites including weight-bearing areas such as the soles, heels, toes, and other protruding areas. Poorly managed diabetic ulcers can progress to gangrene. In Indonesia, studies show that the prevalence of diabetic ulcers ranges from 15-25% among total diabetes patients, with an annual incidence of over 2%, and between 5-7.5% among patients with neuropathy. Epidemiological studies report more than one million amputations performed on diabetic patients annually, with approximately 68% of diabetic gangrene cases occurring in men. Gangrene in DM patients is often caused by anaerobic bacterial infections, predominantly Clostridium, which produces gas gangrene. [1],[3]

Comprehensive management of patients with diabetic ulcers not only reduces the incidence of infection but also improves the patient's quality of life. Patient awareness and knowledge of their condition play a significant role in preventing further complications and improving adherence to treatment and lifestyle modifications. Behavioral changes require intrinsic motivation, supported by

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family and community engagement through a family medicine approach. This approach ensures more comprehensive management, aiming to prevent complications and enhance the quality of life for patients.

CASE REPORT

Mr. E, a 61-year-old male construction worker, visited Pasar Natar Health Center, Lampung, Indonesia on March 2, 2024, for diabetes mellitus follow-up. He reported a new itchy wound near the site of his previous amputation of two toes on his right foot. Diagnosed with diabetes in 2022, Mr. E began taking metformin (500 mg once daily) in 2023, coinciding with his toe amputation. Concerned about worsening foot conditions, Mr. E expressed fears of another amputation and sought guidance on managing his symptoms and preventing further complications. He had minimal knowledge about diabetes-related wound care.

Despite a lack of specialized foot care post-amputation, Mr. E's dietary habits were irregular. He consumed packaged coffee 7-8 times daily, smoked one pack of cigarettes per day, and ate two large, unvaried meals per day, typically consisting of rice, tofu/tempeh, and small portion of vegetables. Living with his wife, a 58-year-old homemaker, Mr. E had a supportive but minimally informed family dynamic. Neither he nor his family routinely participated in chronic disease management programs (Prolanis). He expressed concern about his limited understanding of diabetes, complications, and proper wound care practices.

Physical examination revealed a generally mild condition: *Compos-mentis*, weight 50 kg, height 158 cm (BMI 20 kg/m², normoweight), blood pressure 124/73 mmHg, pulse 82 bpm, respiratory rate 20 bpm, temperature 36.6°C. General status revealed that the head, neck, thorax, and abdomen were within normal limits. Localized examination on plantar region dextra showed a 10 cm x 1 cm x 0.5 cm. On palpation, the skin was dry, with edema (-), hyperemia (-), pus (-), bleeding (-), necrotic tissue present (+), odor (-), muscle tissue not yet visible, tenderness (-), capillary refill time (CRT) < 2 seconds, ankle-brachial index (ABI) 1.2, and a strong pulse in the right dorsalis pedis artery (+). Neurological examination revealed no motor weakness, and no sensory disturbances were found in pain and temperature testing of both hands and feet. No abnormalities were detected in vibration testing of both hands and feet. Physiological reflexes, including the patellar and Achilles reflexes, were within normal limits. No pathological reflexes were observed, including the Babinski, Chaddock, Gordon, Gonda, Schaefer, and Oppenheim reflexes.

Figure 1. Localized Examination

The laboratory results showed a random blood glucose (RBG) level of 303 mg/dL. According to the medical records, the patient's random blood glucose was checked monthly during routine medication refills, with 500 mg Metformin tablets taken once daily. The RBG results consistently exceeded 200 mg/dL, indicating that the patient's glycemic control has not been achieved with this treatment regimen.

FAMILY DATA

The patient's family structure is a nuclear family, consisting of the patient, his wife, and their child. The relationships among family members are good and close-knit. Communication among family members is open and unrestricted. Decisions within the family are made by the patient as the head of the household. The patient's relationship with the surrounding community is positive. The patient has two children, one male and one female, who live separately from the patient.

The relationship among Mr. E's family can be seen in Figure 2.

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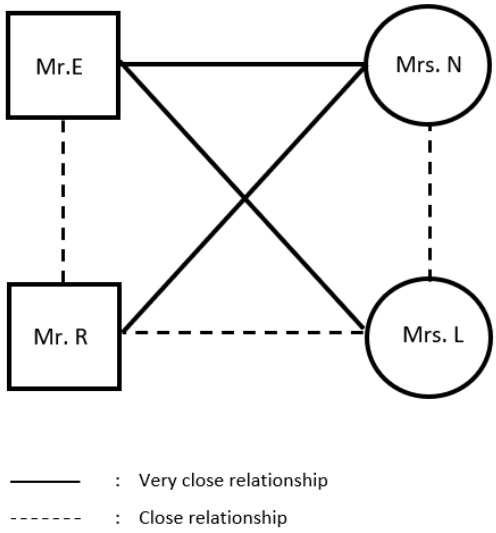

Figure 3. Mr. E's Family Map

The Family APGAR Score for Mr. E's family showed a total score of 8, with the following breakdown: Adaptation (2), Partnership (1), Growth (1), Affection (2), Resolve (2). The interpretation of Mr. E's family is that there is no family dysfunction. According to Duvall's Family Life Cycle stages, the patient's family is in Stage VIII, which is the "Aging Family" stage, as shown in Figure 4.

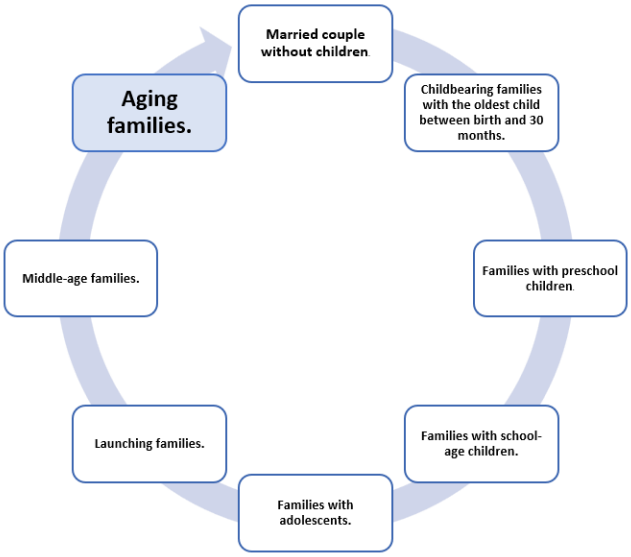

Figure 4. Mr. E's Family Lifecycle

The patient lives in a house categorized as unhealthy. The house measures 6x9 m² and is single-story. It has a front porch, one living room, one bedroom, one kitchen, and one bathroom with a squat toilet. The walls are made of wood, the floor is made of cement (not tiled), and the roof is constructed of wood with red brick tiles covering all rooms. The kitchen is located inside the house. The lighting in the house is insufficient, as there are only two small windows in the living room and one small window in the bedroom. The bedroom window is not always opened, resulting in inadequate lighting and ventilation, which leads to a damp condition. The house is electrified, and the water source comes from a borehole. The kitchen is equipped with a gas stove, and drinking water comes from boiled water. There are two trash bins: one inside the house and one outside.

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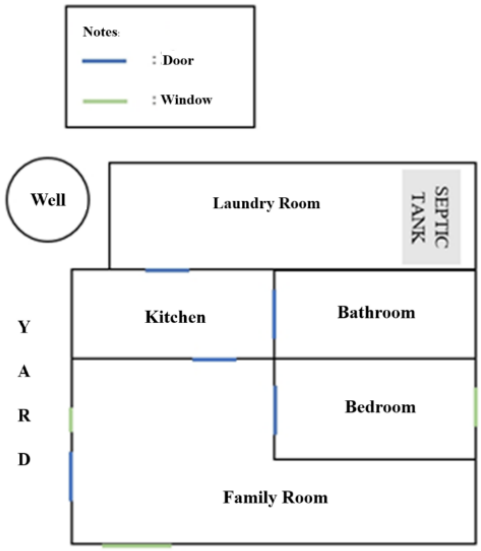

Figure 5. Mr.E's House Floor Plan

Initial Holistic Diagnosis

Personal Aspect

- **Reason for visit**: The patient came to collect medication for diabetes mellitus (ICD-10-E11, ICPC-2-T90) and to manage the wound from an amputation and diabetic wound on the right foot (ICPC-2-L17).
- **Concerns**: The patient is worried that the disease will worsen and hinder daily activities (ICPC-2-Z11; Z28).
- **Perception**: The patient perceives that diabetic wounds are similar to other wounds and do not require special care (ICPC-2-Z07).
- **Expectations**: The patient hopes that the condition will not worsen (ICPC-2-Z11).

Clinical Aspect

- Type 2 Diabetes Mellitus with diabetic foot ulcer (ICD-10-E11.621; ICPC-2-T90).

Internal Risk Aspects

- The patient is 61 years old (ICD-10-R54).
- The patient's sister has a history of diabetes mellitus (ICD-10-Z83.3).
- The patient follows a curative treatment pattern (ICPC-2-Z10).
- Lack of physical activity (ICD-10-272.3).
- Insufficient knowledge about proper dietary patterns and nutrition intake (ICPC-2-Z02).
- Limited knowledge regarding (ICD-10-Z55.9; ICPC-2-Z07): • The importance of regular medication, proper dietary patterns, and physical activity for diabetes management. • The complications of diabetes mellitus. • Diabetic wound care and foot care for diabetic patients.

External Risk Aspects

- The family follows a curative treatment pattern (ICPC-2-Z10).
- The family's support in motivating the patient to manage diet, physical activity, wound care, and regular medication intake is inadequate (ICPC-2-Z07).

Functional Degree

- Based on the Dartmouth COOP Functional Health Assessment Charts, the patient's functional degree is classified as degree 2, meaning the patient is able to perform self-care and light daily activities both inside and outside the home but is starting to reduce work-related activities.

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INTERVENTION

The interventions performed are divided into patient-centered, family-focused, and community-oriented categories. A total of three visits were conducted. The first visit was to complete the patient's data, conduct a pre-test on the patient's knowledge of diabetes and its complications, and monitor the patient's condition. The second visit was for interventions, and the third visit was to evaluate the interventions that had been carried out. The evaluation of the patient-centered intervention was assessed using physical examination and post-test, while the family-focused evaluation was assessed using a post-test.

The patient-centered interventions included non-pharmacological management, which involved education and counseling using media such as PowerPoint presentations and posters, covering topics such as the definition, causes, transmission, and management of the disease, as well as control and prevention to avoid further complications. Education and counseling on healthy lifestyle and dietary patterns for diabetic patients were also provided. Dietary counseling was given with a list of foods to avoid and those allowed. Additionally, education on clean and healthy living behaviors, as well as the importance of maintaining personal hygiene, home cleanliness, and the environment to prevent infection in diabetic ulcers, was given.

Pharmacological management was based on the patient's uncontrolled blood glucose levels, with Metformin 500 mg once daily. An increase and addition of a Sulfonylurea class medication was made, changing the dosage to Metformin 500 mg three times daily before meals and adding Glibenclamide 5 mg once daily in the morning after meals. The patient did not show signs of hypoglycemia, such as weakness, loss of consciousness, or blurred vision, after this therapy. Since the formation of diabetic ulcers is closely related to neurological disturbances, Vitamin B Complex 1 tablet daily was prescribed as a neuroprotector. To address itching on the patient's feet, an H2 antihistamine, Cetirizine 10 mg once daily, was given when itching occurred. On local examination, the wound area was found to be very dry. To care for the diabetic wound, which requires a moist and clean environment, Hyaluronate Acid + Zinc Oxide cream was applied twice daily, and wound dressing was changed twice a day. To prevent further infection of the diabetic ulcer, Gentamicin ointment was applied three times daily to the diabetic wound.

Family approach interventions included non-pharmacological therapy, such as educating the family on the importance of regular health check-ups and motivating family members to help manage the patient’s diet, physical activity, wound care, and routine medication adherence. Community-oriented interventions included educating the patient about the regular management of chronic disease programs (Prolanis).

The final holistic diagnosis of the patient includes four aspects.

- **Personal Aspect**: The patient undergoes regular health check-ups, and the symptoms have decreased. The patient’s concerns have reduced with an increase in knowledge related to the disease. The patient understands how to care for diabetic wounds and independently practices wound care. Most of the patient’s expectations have been met, as the symptoms have improved.
- **Clinical Aspect**: The patient has Type 2 Diabetes Mellitus with diabetic foot ulcer (ICD-10-E11.621; ICPC-2-T90).
- **Internal Risk Aspects**: The patient is aware of the importance of regular health check-ups even without complaints. The patient understands the importance of regular medication, proper diet, and physical activity for DM, is aware of complications related to DM, and understands and practices diabetic wound care independently.
- **External Risk Aspects**: The patient's family will strive to prevent disease and provide support and motivation for managing the patient’s diet and ensuring medication adherence.
- **Functional Degree**: The patient’s functional degree is 2, meaning the patient is able to perform self-care and light daily activities both inside and outside the home, but is beginning to reduce work-related activities.

DISCUSSION

The intervention was conducted as part of family medicine services for Mr. E, a 61-year-old patient with diabetes mellitus (DM) and diabetic foot ulcer, taking a holistic approach to the patient, which included biological, psychological, and social aspects. The importance of a family medicine approach for this patient is due to the chronic nature of the disease, which is influenced by various risk factors and can lead to complications if not properly controlled and managed. The progression of this disease also depends on the patient’s adherence to treatment and the support and knowledge from the family. Three visits were carried out to assess the patient through the family medicine approach, with the first visit focusing on diagnosis confirmation.

Various complaints can be found in DM patients. Suspicions of DM should arise when symptoms such as classic DM symptoms—polyuria, polydipsia, polyphagia, and unexplained weight loss—are present. Additional complaints include body weakness, tingling,

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itching, blurred vision, erectile dysfunction in men, and pruritus vulvae in women. A history of gangrene in both toes and the presence of a diabetic wound suggest the presence of chronic macrovascular and microvascular complications. Gangrene, or tissue death due to inadequate blood supply, is accompanied by numbness, which is one of the microvascular complications of DM. This can be clinically confirmed using the Neuropathy Symptom Score (NSS) and Neuropathy Deficit Score (NDS) questionnaires. Based on the results of the questionnaires, the NSS score was 4, which can be interpreted as a "low risk" for diabetic neuropathy. The NDS score was 0, indicating no diabetic neuropathy. This explains the itching sensation that the patient still experienced on his right foot. Further nerve examination using Nerve Conduction Study (NCS) or Electromyography (EMG) is still necessary to confirm Diabetic Neuropathy.[4],[5]

According to the patient's history, he was diagnosed with diabetes mellitus two years ago, with a family history of diabetes in his younger sister. The patient's parents' history of DM is unknown. The patient has a history of physical inactivity, a diet high in carbohydrates and sugar. The risk of developing Type 2 Diabetes Mellitus (T2DM) increases 2-6 times in individuals with a family history of DM compared to those without. Physical activity can reduce the development of T2DM by 30-50%, and a high carbohydrate intake, comprising 70% of total calories, increases the risk of developing T2DM.[6],[7]

The patient also has behavioral risk factors such as irregular eating habits and a lack of exercise. The patient has limited knowledge about his disease, particularly regarding appropriate dietary patterns, physical activity, and the complications associated with DM, including diabetic foot ulcers. The patient's treatment approach has been curative, with visits only occurring when complaints arise, and the patient has insufficient knowledge regarding diabetic foot care. Risk factors related to lifestyle include limited physical activity and poor dietary habits, such as irregular eating and excessive consumption of packaged coffee drinks while consuming insufficient vegetables and fruits.[8],[9]

At the time of the pre-test, the patient scored 60, indicating a lack of knowledge about DM and foot care in general. Non-pharmacological interventions were carried out using a poster that provided information on the definition, complications, dietary patterns, and physical activity for DM and hypertension. The patient was also taught how to perform foot exercises to help improve blood circulation in the feet. Additionally, nutritional requirements were calculated through a food recall, and a printed copy of the poster was provided. The importance of taking DM medication and caring for the feet to prevent further diabetic ulcers was also explained, along with recommendations for routine monthly check-ups to monitor blood sugar levels. After explaining these to the patient, counseling was conducted with a focus on the patient's specific problems, such as dietary recommendations, what foods should be consumed or avoided, and encouraging the patient to apply these teachings for the upcoming weeks, followed by an evaluation. Family education, particularly to the patient's wife, was also carried out on the importance of regular disease screening and maintaining a proper diet and physical activity.

The diet for a DM patient should be tailored to their caloric needs. DM patients should consume foods with a low Glycemic Index (GI). The Glycemic Index is categorized into three levels: high (>70), moderate (55-70), and low (<55). Higher GI foods increase the rate at which carbohydrates are absorbed and converted into sugar, leading to higher blood sugar levels. Daily dietary recommendations for DM patients include consuming 45-65% of total energy intake from carbohydrates, especially high-fiber carbohydrates, 20-25% of energy from fats (not exceeding 30%), and 10% from proteins. Sodium intake for DM patients should be less than 1500mg per day, the same as for healthy individuals. The recommended fiber intake is 20-35 grams per day. Meals should be divided into three main meals (20% for breakfast, 30% for lunch, 25% for dinner) and 2-3 snacks (10-15%).[3],[10]

Patients with DM should avoid high-glucose drinks such as soda, sweetened tea, energy drinks, and packaged beverages, as they contribute to obesity, increased inflammatory mediators, and a high GI. However, the patient can still consume glucose in seasoning and other foods consumed by family members. Excessive intake of saturated fats, such as red meat and full-cream dairy products, should be limited. Recommended protein sources for DM patients include fish, squid, lean meats, low-fat dairy, legumes, tofu, and tempeh.[10],[11]

Regular physical activity for DM patients should include moderate-intensity exercises such as walking, cycling, jogging, or swimming for 30-60 minutes per day, or at least 3 times a week. The recommended physical exercises help maintain fitness, reduce weight, improve insulin sensitivity, and control blood glucose levels, while also lowering blood pressure by 4-9 mmHg. One exercise recommended for DM patients is diabetic foot exercises. These exercises prevent wounds and promote blood circulation in the feet. The movements help strengthen the small muscles and thigh muscles to prevent foot deformities and address joint mobility limitations. Diabetic foot exercises positively impact other pathological factors associated with peripheral neuropathy, improving

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microvascular function and fat oxidation, reducing oxidative stress, enhancing blood flow to the periphery, strengthening muscles, slowing peripheral neuropathy progression, and improving sensory, motor, and autonomic functions. [10],[11],[12],[13]

Pharmacological interventions include administering antidiabetic medication and focusing on diabetic wound care. In this case, the patient is using Metformin 500mg three times daily and Glibenclamide 5mg once daily, taken in the morning. Metformin is an insulin-sensitizing drug used as a first-line treatment for DM, and is commonly used in healthcare settings due to its mechanism of action, which reduces liver glucose production and improves insulin sensitivity with minimal risk of hypoglycemia, good availability, and low cost. The maximum dose of Metformin is 2000mg/day. Glibenclamide is a second-generation sulfonylurea antidiabetic drug that lowers blood glucose by stimulating insulin secretion from pancreatic beta cells through an interaction with ATP-sensitive potassium channels. The maximum dose of Glibenclamide is 20mg/day. It is also recommended that the patient undergo regular evaluations, such as HbA1C tests, to ensure that the treatment follows DM management algorithms and achieves therapeutic targets.[14]

The overall goal of DM management is to improve the quality of life for diabetic patients, including short-term objectives such as eliminating DM symptoms, improving quality of life, and reducing acute complications. Long-term goals include preventing and delaying complications, with the ultimate goal of reducing DM-related morbidity and mortality. Healthy lifestyle behaviors for DM patients include adhering to recommended dietary patterns, regular physical activity, consistent DM medication use, and regular monitoring of blood glucose and blood pressure to evaluate the effectiveness of the treatment.[3]

For patients with DM complications such as diabetic foot ulcers, wound care is essential, and patients need to be trained in performing proper diabetic foot and wound care while being informed about the risks of inadequate wound management. Diabetic foot ulcers are associated with neuropathy, peripheral artery disease (PAD), poor foot hygiene, and inadequate skin hydration. Wound care for diabetic ulcers includes both surgical and non-surgical debridement, with non-surgical agents such as topical therapies that may contain hydrogel for autolytic debridement and collagen for enzymatic debridement. Furthermore, appropriate wound dressing should be applied to create a moist environment that promotes granulation, autolysis, angiogenesis, and epidermal cell migration. If excessive exudate is present, foam dressings may be used. Prior to dressing, topical treatments such as sodium alginate or calcium sodium can be applied to absorb exudate, along with antiseptics and antimicrobials. Additionally, patients may be given creams containing hyaluronic acid to accelerate tissue regeneration in diabetic wounds. Education is also necessary to avoid excessive pressure on the wound by using footwear that reduces vertical pressure on the plantar surface, such as modified shoes, boots, or walking aids like canes. If diabetic wounds are not properly managed, there is a risk of deepening and expanding the ulcer, leading to infection, which may warrant the use of systemic antibiotics in addition to topical treatments, particularly in severe infection cases. Patients should also be emphasized on the importance of regular blood sugar monitoring, routine DM medication adherence, and maintaining a healthy lifestyle.[1],[15]

A third home visit was conducted to evaluate the interventions. The evaluation aimed to assess whether the interventions achieved their targets. The results showed clinical improvements in the patient, with increased hydration around the diabetic ulcer, no complaints of itching, and no other reported symptoms. The patient's and family's knowledge of DM, complications, and diabetic wound care improved, as evidenced by the increased scores from the pre-test to the post-test. Behavioral changes in the patient were noted, including regular medication adherence, physical activity, dietary adjustments, wound care, and consistent foot hygiene. The patient also understands that, regardless of symptoms, they must continue taking DM medication and monitor blood sugar levels at least monthly. The patient expressed a positive impression of the interventions, especially the home visit approach. According to the patient, there was an increase in satisfaction with healthcare services and a sense of trust in healthcare providers, as they felt particularly cared for in the management of their diabetic foot ulcer.

During this evaluation, physical examination revealed blood pressure of 118/73 mmHg, heart rate of 82 beats per minute, respiratory rate of 20 breaths per minute, and temperature of 36.9°C. Local examination of the patient's right foot showed early angiogenesis and granulation in the foot ulcer, with no pus or exudate. Blood glucose testing showed a result of 163 mg/dL, indicating improved glucose control in the patient with Type 2 diabetes mellitus. This condition is chronic, and chronic diseases like DM have a long course, with treatment generally aimed at reducing severity or preventing complications. Therefore, patients are advised to regularly visit healthcare facilities for blood sugar check-ups. Since the patient has health insurance, access to healthcare services for regular check-ups is facilitated.

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The evaluation of the patient's wound care was based on the patient's ability to maintain a moist wound environment and reduce pressure on the foot, which was appropriate. The evaluation of dietary changes, assessed through food recall, also showed compliance. The patient began adopting a healthier lifestyle by adjusting their diet to meet nutritional needs, eating regularly, avoiding foods high in sugar, especially simple sugars, and replacing packaged coffee with occasional consumption of ground coffee sweetened with corn sugar. The patient also began engaging in regular physical activity, such as walking in the evenings and performing diabetic foot exercises for at least 30 minutes, 2-3 times a week. The patient reported decreased concerns due to improved knowledge and understanding of their condition. The patient's perception of the foot ulcer also changed, as they recognized that proper care and well-controlled blood sugar would prevent the ulcer from worsening or new ulcers from forming.
The family approach evaluation was conducted using a post-test to assess the family's knowledge of diabetic wound care and proper medication adherence. The results showed an improvement in scores from the pre-test, and the family is now capable of performing proper diabetic wound care for the patient.

CONCLUSION

Based on this case, health issues were identified in a patient, Mr. E, a diabetic foot ulcer sufferer with uncontrolled Type 2 Diabetes Mellitus and a history of right toe amputation (digits III-IV). A low-risk score on the NSS indicates that, subjectively, there are no signs of peripheral nerve damage; however, further examination is still required to confirm the diagnosis of neuropathy. The patient's and family's limited knowledge about the condition posed a risk factor for complications. Holistic and comprehensive management was provided to the patient and family, including pharmacological and non-pharmacological interventions, with the aim of controlling the diabetes mellitus and properly managing the diabetic foot ulcer to improve the patient's quality of life.

DECLARATION OF PATIENT CONSENT

The authors certify that they have patient consent for his images and other clinical information to be reported in the journal.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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