RIASE
REVISTA IBERO-AMERICANA DE SAÚDE E ENVELHECIMENTO
REVISTA IBERO-AMERICANA DE SALUD Y ENVEJECIMIENTO

NURSING CARE FOR PEOPLE WITH DIABETIC FOOT ULCERS: CASE REPORT

CUIDADOS DE ENFERMAGEM À PESSOA COM ÚLCERA DO PÉ DIABÉTICO: RELATO DE CASO

CUIDADOS DE ENFERMERÍA A PERSONAS CON ÚLCERAS DE PIE DIABÉTICO: RELATO DE CASO

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Received/Recebido: 2025-06-18 Accepted/Aceite: 2025-06-24 Published/Publicado: 2025-06-24

DOI: http://dx.doi.org/10.60468/r.riase.2025.11(1).757.54-65

VOL. 11 NO. 1 APRIL 2025

Abstract

Introduction: Diabetic foot syndrome is a serious complication of Diabetes Mellitus, characterized by lesions in the lower limbs that negatively affect skin integrity, mobility, and quality of life. The risks of infection, pain, amputation, and functional limitations significantly compromise the person's overall well-being. Nursing plays a central role in the assessment, management, and rehabilitation of these conditions, promoting individualized care. **Objective:** To develop a person-centered nursing care plan focused on improving the quality of life in the context of diabetic foot ulcers. **Methodology:** Case report of a patient with a diabetic foot ulcer, followed in hospital outpatient consultations. The assessment was guided by Nancy Roper's model, and the care plan was constructed based on the CIPE®, NIC, and NOC classifications. **Results:** Four nursing diagnoses were identified: active diabetic foot ulcer, current infection, risk of malnutrition, and current social isolation. Corresponding nursing interventions and expected and observed outcomes were described. **Conclusion:** Due to its chronic nature and associated complications, such as diabetic foot, Diabetes Mellitus has a substantial impact on individuals' quality of life, affecting their functionality, autonomy, and overall well-being. The nurse's intervention—supported by theoretical models and standardized classifications—encompasses actions aimed at preventing, treating, or rehabilitating such complications, through individualized care that promotes quality of life improvement.

Keywords: Diabetic Foot; Diabetes Mellitus; Nursing Care; Osteomyelitis; Plasma.

Resumo

Introdução: A síndrome do pé diabético é uma complicação grave da Diabetes *Mellitus*, associada a lesões nos membros inferiores com impacto negativo na integridade cutânea, mobilidade e qualidade de vida. O risco de infeção, dor, amputação e limitação funcional compromete o bem-estar global da pessoa. A enfermagem desempenha um papel central na avaliação, gestão e reabilitação destas situações, promovendo cuidados individualizados. **Objetivo:** Desenvolver um plano de cuidados de enfermagem centrado na pessoa, com foco na promoção da qualidade de vida em contexto de úlcera do pé diabético. **Metodologia:** Relato de caso clínico de um utente com úlcera do pé diabético, seguido em consultas externas hospitalares. A avaliação foi orientada pelo modelo de Nancy Roper e o plano de cuidados construído com base nas classificações CIPE®, NIC e NOC. **Resultados:** Foram identificados quatro diagnósticos de enfermagem: úlcera do pé diabético ativa, infeção atual, risco de malnutrição e isolamento social atual. Foram descritas as respetivas intervenções de enfermagem e os resultados esperados e obtidos. **Conclusão:** A Diabetes *Mellitus*, pela sua natureza crónica e pelas complicações associadas, como o pé diabético, tem um impacto expressivo na qualidade de vida das pessoas, afetando a sua funcionalidade, autonomia e bem-estar global. A atuação do enfermeiro, sustentada em modelos teóricos e classificações normalizadas, passa por ações de prevenção de complicações ou de reabilitação/tratamento das mesmas, tendo em vista a prestação de cuidados individualizados que promovam a melhoria da qualidade de vida.

Palavras-Chave: Cuidados de Enfermagem; Diabetes *Mellitus*; Osteomielite; Pé Diabético; Plasma.

Resumen

Introducción: El síndrome del pie diabético es una complicación grave de la Diabetes *Mellitus*, asociada a lesiones de las extremidades inferiores con un impacto negativo en la integridad de la piel, la movilidad y la calidad de vida. El riesgo de infección, dolor, amputación y limitación funcional pone en peligro el bienestar general de la persona. La enfermería desempeña un papel central en la evaluación, gestión y rehabilitación de estas situaciones, promoviendo cuidados individualizados. **Objetivo:** Desarrollar un plan de cuidados de enfermería centrado en la persona y enfocado a promover la calidad de vida en el contexto de las úlceras de pie diabético. **Metodología:** Reporte de caso clínico de una paciente con úlcera de pie diabético, seguida en consultas externas del hospital. La evaluación se guió por el modelo de Nancy Roper y el plan de cuidados se basó en las clasificaciones CIPE®, NIC y NOC. **Resultados:** Se identificaron cuatro diagnósticos de enfermería: úlcera de pie diabético activa, infección actual, riesgo de desnutrición y aislamiento social actual. Se describieron las respectivas intervenciones de enfermería y los resultados esperados y obtenidos. **Conclusión:** La Diabetes *Mellitus*, debido a su carácter crónico y a las complicaciones asociadas como el pie diabético, tiene un impacto significativo en la calidad de vida de las personas, afectando a su funcionalidad, autonomía y bienestar general. El papel de la enfermera, basado en modelos teóricos y clasificaciones estandarizadas, implica actuaciones para prevenir las complicaciones o rehabilitarlas/tratarlas, con el fin de proporcionar cuidados individualizados que promuevan la mejora de la calidad de vida.

Descriptores: Cuidados de Enfermería; Diabetes *Mellitus*; Osteomielitis; Pie Diabético; Plasma.

Introduction

Diabetes Mellitus (DM) is a metabolic disorder that integrates chronic non-communicable diseases. According to the World Health Organization (WHO), it is considered a public health problem, as there has been an increase in the number of cases in recent years. It is estimated that more than 420 million people worldwide are affected by DM, with a predicted increase to 700 million by 2045. Therefore, there is a growing awareness of this disease[1].

It is estimated that up to 25% of people with diabetes will develop foot ulcers. Its development is multifactorial, including trauma, neuropathy with loss of protective sensitivity and peripheral vasculopathy. Complications of diabetic foot ulcers represent a major cause of morbidity, with infection being the most common complication, affecting up to 60% of people. About 20% of people with infection develop osteomyelitis, which is the main risk factor for amputations[2].

The diagnosis of osteomyelitis can be performed using analytical, clinical (probe-to-bone test) and imaging tests. Bone biopsy through surgical debridement or percutaneous biopsy are the standard methods for diagnosis, since osteomyelitis results from direct bacterial extension into the exposed bone, and these methods provide information about the pathogenic agent and ensure a more appropriate choice of antibiotic (AB)[2].

This study allowed a holistic assessment of the user, enabling the identification of their needs and the consequent elaboration of a nursing care plan focused on improving their quality of life. At the same time, we intend to observe the impact of the application of Cold Plasma as a complementary therapeutic approach, evaluating its effectiveness in the treatment of diabetic foot ulcers in this specific case. The user was selected from outpatient consultations at a hospital located in the Alentejo region, southern Portugal. To carry out this work, informed consent was obtained, respecting the ethical, legal, deontological and moral principles of the profession. The identification data was anonymized, with the user referred to through a fictitious initial.

Methodology

This article corresponds to a case report of a descriptive and observational nature, in which nursing diagnoses, interventions performed and results obtained in the monitoring of the user under study are presented. The preparation of this report followed the CARE (CAse REport Guidelines) guidelines recommended by the EQUATOR Network, as well as the Vancouver bibliographic formatting standards. The objective is to critically reflect on the nursing process in the context of caring for people with diabetic foot ulcers. This work is also based on a bibliographic review, carried out through the EBSCO database, using scientific articles selected through terms validated on the DeCS platform: Diabetes Mellitus, Diabetic Foot, Nursing Care, Osteomyelitis, Plasma and Treatment.

This research made it possible to deepen knowledge about Diabetes Mellitus and some of its most relevant complications, namely, diabetic foot ulcers, osteomyelitis and amputation, with a special focus on the application of Cold Plasma as an innovative therapy in the treatment of wounds. The data obtained in the literature review were later compared with the results of a real clinical case, involving a user diagnosed with Diabetes Mellitus, foot ulcer with bone exposure and osteomyelitis. Data collection was carried out through semi-structured interviews, direct observation and physical examination, complemented by consulting the electronic medical record in the SClínico system, in order to guarantee the integrity and completeness of the information necessary for the analysis of the case.

All information collected, including photographic records, were previously authorized by the user by signing a Free and Informed Consent Form, validated by the State Health Department (DGS)[3]. The user was duly informed about the objectives of the study, and anonymity, data confidentiality and respect for the ethical and legal principles governing health practices were ensured at all stages of the process.

To explain the case report in a systematic way, a flowchart was prepared according to the CARE guidelines[4].

This study is based on the Activities of Daily Living Model by Nancy Roper, Winfred Logan and Alison Tierney, which allows the construction of a nursing care plan comprising the four concepts – person, health, environment and nursing[8].

To carry out the care plan and develop nursing diagnoses, the International Taxonomy of Nursing (ICNP) was used[5], nursing interventions were identified through the Nursing Intervention Classification (NIC)[6] and the results and final evaluation were performed according to the Nursing Outcome Classification (NOC) language[7]. It is important to emphasize that the taxonomies used are described in Brazilian Portuguese, and this same language was used.

Maintaining a safe environment: User guided in all references, thus being able to assess the risks associated with their external environment. He has his own house, suitable and adapted to his physical limitations, where he lives with his wife. Complies with routine consultations and health surveillance and wound treatment. Quality of life assessment questionnaires were applied, namely, the WHOQOL-Bref[9] with an overall score of 25 (first time it was applied) and the Cardiff Wound Impact Scheme (CWIS)[10] where the user evaluates their quality of life as 8, on a scale of 0 to 10, where 10 is the best possible quality of life. The risk of falling was also assessed using the Morse Scale[11], with a score of 50 (low risk of falling). Mr. J. has a foot ulcer with osteomyelitis; at the moment he has no other wounds. Therefore, it is moderately dependent, leading to the following diagnoses:

Diagnosis: Diabetic Foot Ulcer; Judgment: Current – Potentiality: Present or real Current[5].

Interventions: to remove dressing material and adhesive tape; to monitor lesion characteristics, including drainage, color, size, and odor; to measure the wound bed as appropriate; to clean with saline solution; to provide care for skin ulcers; to apply a dressing appropriate to the type of injury; to maintain clean technique when dressing the wound; to change the dressing according to the amount of exudate; to

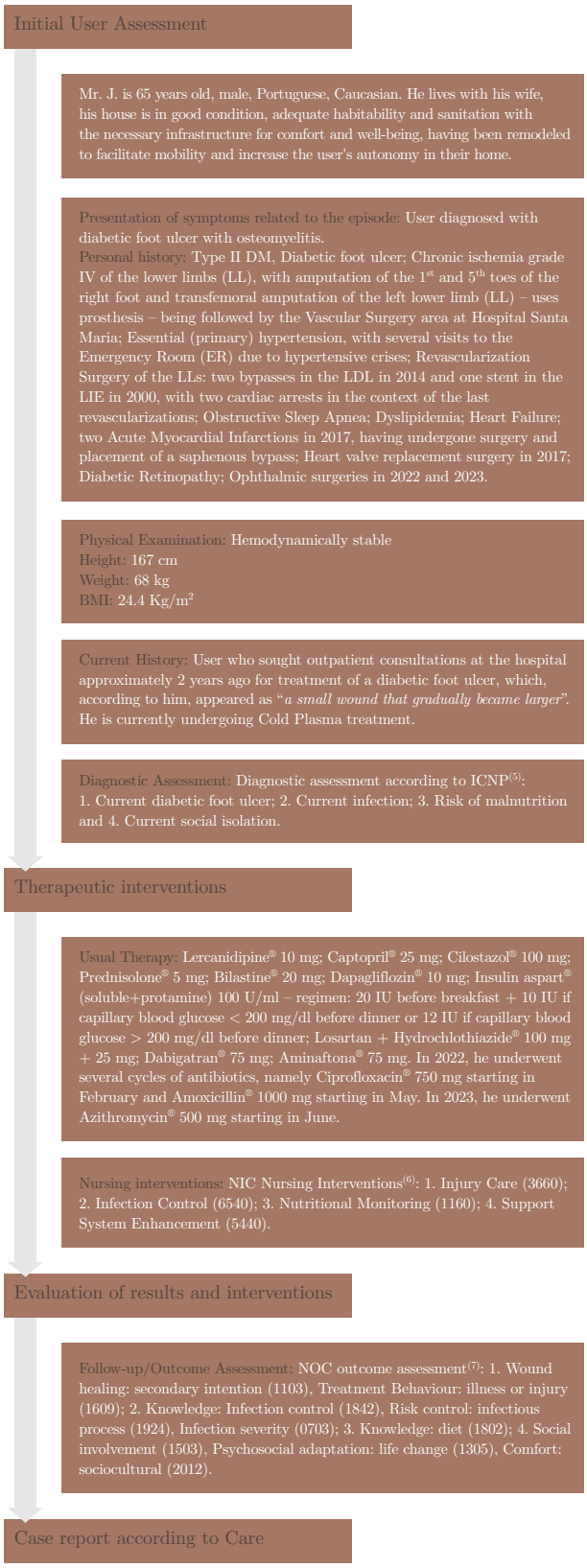

Figure 1: Flowchart according to CARE[4].

examine the injury at each dressing change; regularly compare and record all changes in the lesion; to guide the user and family on injury care procedures; to guide the user and family about signs and symptoms of infection; to document the location, size and appearance of the lesion[6].

Expected results: Wound healing: secondary intention (1103) – "Achievement of cell and tissue regeneration in an open wound"; Treatment Behavior: Illness or Injury (1609) – "Personal actions to reduce or eliminate pathology"[7].

Table 1: Evolution of the diagnosis "Diabetic Foot Ulcer".

Indicators	Initial score	Obtained score	General graduation
Granulation (110301)	2	4	The scale ranges from 1 (None) to 5 (Extensive)
Purulent Drainage (110303)	4	5	
Edema around the wound (110308)	1	3	The scale ranges from 1 (Extensive) to 5 (None)
Macerated skin (110311)	1	3	
Unpleasant odor from the wound (110317)	2	4	
Compliance with recommended precautions (160901)	4	4	The scale ranges from 1 (Never Demonstrated) to 5 (Consistently demonstrated)
Compliance with the medication regime (160905)	5	5	
Compliance with prescribed diet (160919)	3	4	
Avoid behaviors that enhance the pathology (160906)	3	4	
Monitoring the therapeutic effects of treatment (160909)	3	4	
Monitoring changes in disease condition (160911)	4	4	

Diagnosis: Infection; Judgment: Current – Potential: Present or actual Current[5].

Interventions: Properly clean the environment after each user; change the equipment for user care according to the institution's protocol; use antimicrobial soap to wash hands; use gloves, as required by universal precautions protocols; use protective clothing or aprons when handling dirty material; clean the user's skin with an antimicrobial agent; ensure the use of the appropriate technique in wound care; promote adequate nutritional intake; encourage water intake; encourage rest; administer antibiotic therapy; instruct the user to take antibiotics, as prescribed; instruct the user and family on the signs and symptoms of infection and when to report them to the health professional; teach the user and family how to avoid infections[6].

Expected results: Knowledge: Infection control (1842) – "Scope of understanding conveyed about infection, its treatment and the prevention of complications"; Risk control: infectious process (1924) – "Personal actions to prevent, eliminate or reduce the threat of infection"; Infection severity (0703) – "Severity of infection and associated symptoms"[7].

Communication: The patient presents coherent, logical and well-flowing thoughts. He expresses himself spontaneously, using common language and a normal tone. The patient identifies the application of the dressing as the only time he feels pain. Using the Numerical Pain Intensity Scale[12], score of 4 was obtained when the dressing was applied, stating that the pain was tolerable and that it was not necessary to resort to analgesia prior to treatment.

Breathing: The patient is eupneic in room air with a thoracoabdominal movement pattern. He has sleep apnea, which is why he requires CPAP at night. Mr. J. reports monitoring his blood pressure twice a week and, according to him, he remains normotensive and normal-cardiac.

Diet: He is a diabetic patient, and tries to maintain a varied diet, low in salt, rich in protein, with no carbohydrate restrictions; he reports being independent in assessing his capillary blood glucose and administering insulin, which he does daily. According to the patient himself, his values are within parameters considered normal. His meals are prepared by his wife. He eats independently and maintains his appetite. He drinks about 1.5 L of water per day. Although the patient reports having a healthy diet, the Mini Nutritional Assessment (MNA)®[13] was used as a tool to assess the risk of malnutrition, and a score of 11 was obtained, which shows that the patient is at risk of malnutrition. The patient is moderately dependent on this ADL.

Table 2: Evolution of the diagnosis "Infection".

Indicators	Initial score	Obtained score	General graduation
Signs and Symptoms of Infection (184204)	3	3	The scale ranges from 1 (No Knowledge) to 5 (Broad Knowledge)
Importance of hand hygiene (184207)	3	4	
Treatment for a diagnosed infection (184209)	2	3	
Follow-up of a diagnosed infection (184210)	3	3	
Signs and symptoms of an infection flare-up (184211)	2	3	
Importance of adherence to treatment (184217)	3	3	
Importance of completing the medication regimen (184220)	3	3	
Influences of nutritional practices on infection (184221)	2	3	
Recognizes personal risk of infection (192401)	3	4	The scale ranges from 1 (Never Demonstrated) to 5 (Consistently Demonstrated)
Recognizes the personal consequences associated with infections (192402)	3	4	
Hand cleaning practice (192415)	3	4	
Fever (070307)	5	5	The scale ranges from 1 (Severe) to 5 (None)
Pain (070333)	3	3	

Diagnosis: Malnutrition; Assessment: Risk – Potential: impossibility; risk[5].

Interventions: monitor trends in weight gain and loss; monitor the occurrence of dry skin, with flaking and depigmentation; monitor food preferences and choices; monitor energy levels, malaise, fatigue and weakness; monitor redness, swelling and fissures in the mouth/lips; observe the presence of wounds, swelling and hypertrophic and hyperemic papillae on the tongue and oral cavity; observe the occurrence of significant changes in nutritional status and initiate treatments, as appropriate; determine whether or not the patient requires a special diet[6].

Expected results: Knowledge: diet (1802) – "Scope of understanding transmitted about the recommended diet"[7];

Elimination: Without changes in the bladder pattern, it has several distances throughout the day, in the toilet, and of sui generis features. With regard to the intestinal pattern, it does not refer to complaints of constipation or discomfort. It is independent of this ADD.

Personal Hygiene and Clothing: User performs personal hygiene care in a daily WC. The user presents the blocked and hydrated skin and mucous membranes. Careful oral hygiene, without xerostomia or mucositis. It is independent of this ADD.

Body Temperature Control: patient uses apirotic. It is independent on this ADD.

Mobility: User states that in the home, wanders using crutches, however, he resorts to the wheelchair to travel long distances, being autonomous in transfers. Mr. J. tries to remain active by doing physical exercise daily within his abilities. It is independent of this ADD.

Work and Leisure: User is renovated. In his free time, he likes to exercise, spend time with his wife and daughter and likes to watch football. It also states that since the appearance of the wound is not so often with friends. It is dependent to a moderate degree on this ADD.

Table 3: Evolution of the diagnosis "Malnutrition".

Indicators	Initial score	Obtained score	General graduation
Recommended diet (180201)	3	4	The scale varies from 1 (no knowledge) to 5 (broad knowledge)
Dietary justification (180202)	3	4	
Diet Advantages (180203)	3	4	
Foods to be avoided in the diet (180207)	4	4	
Healthy nutritional practices (180220)	3	4	

Diagnosis: social isolation; Judgment: Current – Potentiality: Present or Current Real[5].

Interventions: raise data on the psychological reaction to the situation and the availability of a support system; Identify the degree of family support; Identify support systems currently in use; Monitor the current family situation; Encourage the user to participate in social and community activities; Encourage relationships with people with common interests and goals; Forward the Promotion/Prevention/Treatment/Rehabilitation Program in the Community, as appropriate; Involve the significant family/people/friends in care and planning[6].

Expected results: Social involvement (1503) – "social interactions with people, groups or organizations"; Psychosocial Adaptation: Life Change (1305) – "Psychosocial response of adaptation of an individual to a significant change of life"; State of Comfort: Sociocultural (2012) – "Social Relaxation associated with interpersonal, family and social relations within a cultural context"[7].

Expression of Sexuality: User states to be satisfied with their couple life. It is independent of this ADD.

Sleep: Using no sleep pattern changes, sleeps about 8 h nights. The user is independent of this ADD.

Death: Underwritten did not express difficulty, disability or concern for this ADD.

Table 4: Evolution of the diagnosis "Social Isolation".

Indicators	Initial score	Obtained score	General graduation
Interaction with friends (150301)	2	3	The scale varies from 1 (Never demonstrated) to 5 (consistently demonstrated)
Interaction with family (150303)	5	5	
Participation in organized activities (150307)	2	3	
Participation in Leisure Activities with the others (150311)	2	3	
Uses efficient coping strategies (130509)	2	2	
Uses social support available (130513)	2	2	
Participates in leisure activities (130514)	2	2	The scale ranges from 1 (not demonstrated) to 5 (consistently demonstrated)
Reports feeling socially engaged (130512)	2	2	
Social support of friends (201202)	2	2	The scale ranges from 1 (severely compromised) to 5 (not compromised)
Relations with friends (201204)	3	3	
Confidence in the relationship with friends (201206)	2	2	
Social interaction with others (201207)	3	3	
Able to communicate his needs (201212)	2	2	

Discussion of results

The nursing team plays a fundamental role for the DM user to fulfill and add to treatment, preparing a care plan in conjunction with the person, which allows them to respond to the needs and to evaluate the effectiveness of these same interventions[14].

DM is a chronic metabolic disorder, whose lack of control of this can trigger complications such as coronary artery disease, peripheral arterial disease, cerebrovascular diseases, diabetic retinopathy, nephropathy and neuropathy, as well as an increased risk for the development of foot ulcers, associated with peripheral sensitive neuropathy and skin deformities, feet deformities dry[15,16]. Diabetic foot is a clinical syndrome that involves the presence of ulcerations, infections and/or destruction of deep limb tissues, being generally associated with neurological changes and peripheral vascular disease[1].

It should be noted that amputation can be caused by either infection and ischemia, with osteomyelitis the main cause[17]. Exposure of bone or joint, antecedents of amputations and the presence of one or more wounds constitute some of the risk factors for osteomyelitis. The treatment of this will be influenced by the presence and extension of infection in soft tissues, the presence of necrosis, vascular disease (for this, it is necessary to assess Doppler by calculating the ankle pressure index – IPTB) and the location of the ulcer. That said, surgical or percutaneous bone biopsy is recommended as a method of obtaining contaminated bone for cultivation, thus confirming the definitive diagnosis of osteomyelitis, complement-

ing with the results obtained on simple radiography (RX), and clinical signs of infection.

Conservative treatment is based on the resection of infected bone tissue, with the aim of preventing the evolution to a chronic infection. Therapeutic efficacy is enhanced when this approach is associated with the administration of directed antibiotic therapy and the debridement of the devitalized tissue. The selection of the antibiotic should be performed carefully, taking into account the clinical characteristics of the user and the specific parameters of the infection in question. Osteomyelitis is associated with long-term treatments and a high risk of amputation and mortality. Early diagnosis is important to start antibiotherapy and debridement as soon as possible[18]. Remission is only considered when there are no clinical signs of infection, with decreased inflammatory biomarkers and RX without signs of bone destruction[17].

Mr. J. has a high risk of ulcer development due to his health records. Due to loss of sensitivity, he says he doesn't know what has caused his wound. As mentioned earlier, the wound will have emerged about 2 years ago, and has increased its complexity over this period. According to the data collected from the user and the information available in the Sclinic system, he was under antibiotic coverage for some periods of 2022 and 2023. In June 2022, a superficial purulent exudate harvest was performed, which was positive for *Citrobacter Freundii*. However, it was not possible to complement this information, since the additional data was not available in the computer system and the user did not have sufficient knowledge about the details of the treatment performed. Through information provided by health professionals the user will have performed a "probe-to-bone" positive test. After confirming the diagnosis made a new cyprofloxacin® cycle. In November 2023, he reseated the deteriorated bone, where the lack of sensitivity/pain of the user during the procedure is notorious. From November to December, several treatments with bone resection and debridement of devitalized tissue were performed, and there was a positive evolution of the ulcer during this period. However, in January 2024 there was a stagnation of evolution, the opportunity to integrate the user in an experimental treatment with cold plasma. In the third week of treatment it has characteristics of a good scar prognosis.

According to Neto and collaborators, diabetic foot ulcers lead to repercussions that transcend the physical limitations of the affected limb, significantly interfering with the quality of life of individuals and their caregivers. These lesions are often associated with functional disabilities, increased risk of early mortality, recurring episodes of hospitalization, prolonged rehabilitation processes and need for continuous social support, which contributes to a growing economic and social overload[19]. They have an impact on the autonomy and psychology of these people, with loss of social relations, work and daily life activities where they were previously active[20]. Thus, two evaluation instruments – WHOQOL-Bref of Quality of Life Evaluation and the Cardiff Impact Scheme of the Wound (CWIS) were applied. As for the first instrument, there was an increase from 25 to 62.5 in the general score and the higher the value, the better the quality of life. In the Impact Cardiff scheme the user maintained an assessment of 8 on the scale of 0 to 10.

Analyzing the results of the interventions implemented it can be seen that these were mostly successful, making it possible for Mr. J. to have a positive evolution of wound healing, as well as the control of the infection (osteomyelitis) and the improvement of nutritional intake that culminated with weight gain, considering that it was at risk of malnutrition, and in the mini nutritional evaluation (MNA)® passed to a Score 12 – Normal nutritional state. On the contrary, the user said that he still has some difficulty in socialization and going out with his friends, despite the proposed interventions.

Throughout the preparation of the case report, we followed Mr. J.'s treatment consultations at Portalegre Hospital, and until February 15, 2024 he moved to the same 8/8 days; From this date, he began an experimental treatment with cold plasma, so during the first week she performed 3x treatment in the week, from the second week she met 2 treatments per week for 5 to 6 weeks.

December 20th, 2023

On December 20, 2023, the user presents an ulcer in the heel of the right foot with bone and muscle exposure.

After observation it is verified that the foot is edematic and, using proper measurement material, we identify that the ulcer has dimensions of 5 cm x 9 cm, with bone deterioration, friable granulation tissue and devitalized tissue. The edges are irregular and thickened, with spoils-legged perilerous skin at the bottom of the ulcer, maceration in the external lateral region and flushing at the top.

As for treatment, it began with washing the foot with soap and water (water heated to body temperature), then the bone was performed using the curette and cutting debridement of the devitalized tissue. After wound disinfection with Octtiset® antishetic (octenidine dichloride and phenoxyethanol), antimicrobial hydroalnate pensions with non-adherent silver and polyurethane foam with silicone-ribbed polyurethane was applied.

Figure 2: Right foot with heel ulcer 23/12/20.

January 30th, 2024

On January 30, 2024, it maintained an ulcer with bone exposure, friable granulation tissue and devitalized tissue, which fills the remaining wound bed.

The foot remains edematic and the ulcer has dimensions of 3.5 cm x 6 cm; Irregular and thickened edges, with spoil-length perilsional skin at the bottom and perilerous skin still macerated at the top. The ulcer has less deterioration and bone exposure.

At the time, it maintained the treatment by positive evolution in healing.

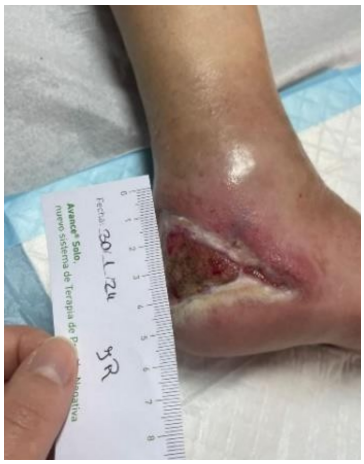

Figure 3: Right foot with heel ulcer 24/01/30.

February 15th, 2024

On February 15, 2024, the foot remains edematic and the ulcer maintains the dimensions (3.5 cm x 6 cm) and characteristics. Despite positive evolution since last week, a difficult wound has been revealed over the years. For this reason, the user has been selected for a case study to perform a case observation with **Plasma Care®** equipment.

Figure 4: Right foot with heel ulcer 24/02/15.

As for treatment, it was washed with soap and water, hydration of the skin with liquid Vaseline and undergoing sharp debridement of the devitalized tissue. Later, started treatment with cold plasma with **Plasma Care®** equipment. After treatment, Iodopovidona® compressed compress was applied and protected with compresses and adhesive.

March 4th, 2024

On March 4, it performed the 8th treatment with **Plasma Care®**, and the foot remains edematic, but the ulcer already had dimensions of 3 cm x 5 cm. It has more granulation tissue and some devitalized tissue, but no longer has bone exposure. In the upper region of the ulcer are borders aligned with the wound bed, however, in the lower and inner side are remaining thickened. Perishalial skin remains whitish, showing improvement in maceration in the external lateral region.

As for treatment, it was washed with soap and water, hydration of the skin with liquid Vaseline and undergoing sharp debridement of the devitalized tissue.

Subsequently, she was treated with cold plasma with **Plasma Care®** equipment. After treatment, non -adherent and compressing silver hydroalginate with compresses and adhesive was applied.

The treatment applied to the user consisted of the use of non -thermal atmospheric pressure plasma, commonly designated by cold plasma, an innovative and promising therapeutic approach in the treatment of chronic wounds. Although underlying cellular and molecular mechanisms are still under study, current evidence indicates that this technology has positive effects on cell migration and proliferation. Studies report an increase in fibroblast migration and proliferation, endothelial, keratinocyic cell proliferation and epithelial cell growth, fundamental elements in the process of tissue regeneration. Additionally, cold plasma induces the production of reactive nitrogen species (RNS), which promote the decrease in local pH, leading to the acidification of the wound microenvironment, a factor that enhances healing[21].

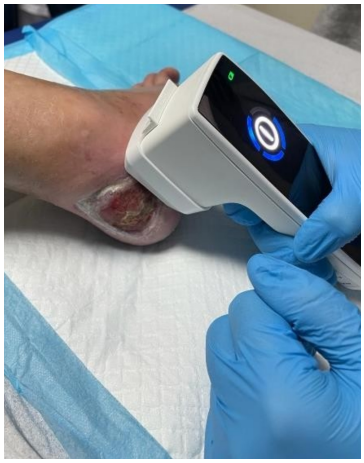

Figure 5: Heel ulcer treatment with plasma care® equipment.

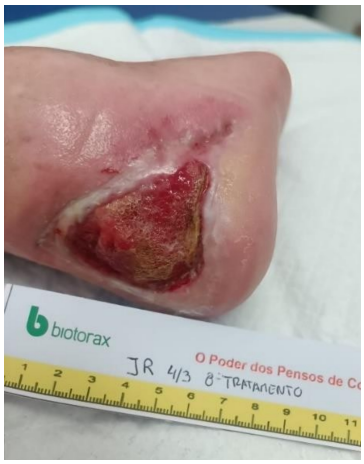

Figure 6: Right foot with heel ulcer 24/03/04.

Conclusions

Advances in healthcare, particularly in complementary diagnostic tests and emerging therapeutic approaches, have enabled more precise and individualized diagnoses in the context of diabetic foot ulcers. This diagnostic accuracy has a direct impact on the selection of more effective interventions, adapted to the clinical specificities of each person. The integration of evidence-based practice into the decision-making process thus plays a central role in the provision of qualified and differentiated nursing care. In the clinical case presented, the differential diagnosis proved to be decisive in defining a more targeted therapeutic plan, allowing the implementation of specific and

effective strategies, with a positive impact on the quality of care provided.

It is essential that people diagnosed with diabetic foot ulcers understand the nature of their condition, as well as the care and precautions necessary to prevent the recurrence of lesions. Therapeutic adherence plays a crucial role in the effectiveness of treatment and in achieving positive clinical results. It is also important to recognise the significant impact that this pathology can have on a person's quality of life, compromising their autonomy, functionality and overall well-being. In this sense, timely and effective intervention is essential, not only with the aim of promoting the healing of lesions, but also of mitigating associated adverse effects, contributing to a sustained improvement in quality of life.

During the preparation of this case study, several constraints were identified that hindered the development of the work, namely the existence of gaps in clinical records, the presence of incomplete or difficult-to-access information, discrepancies between the data recorded on computer media and the information provided verbally by the patient, the limited time for clinical contact and the reduced collaboration of the patient outside the hospital environment. Despite these limitations, the initially proposed objective was achieved. An effective improvement in the patient's quality of life was observed, attributed to the implementation of an individualised care plan, supported by a holistic assessment.

This case report provided an opportunity to develop skills in research, clinical reasoning and the provision of person-centred nursing care. This study reinforces the importance of an individualised approach in the care of patients with diabetic foot ulcers, integrating innovative technologies such as Cold Plasma, with a view to continuous improvement of clinical practice. The articulation between scientific knowledge, holistic assessment and evidence-based care planning allowed not only a more effective intervention, but also contributed to the promotion of the patient's quality of life. These results support the need for further research in this area, particularly around emerging therapies, and highlight the decisive role of the nurse in the management of difficult-to-heal wounds in a clinical context.

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KF: Data analysis, review and discussion of results.
IS: Data analysis, review and discussion of results.
MC: Data analysis, review and discussion of results.
All authors have read and agreed with the published version of the manuscript.

Ethical Disclosures/Responsabilidades Éticas
Conflicts of Interest: The authors have no conflicts of interest to declare.
Financial Support: This work has not received any contribution, grant or scholarship.
Provenance and Peer Review: Not commissioned; externally peer reviewed.
Conflitos de Interesse: Os autores declararam não possuir conflitos de interesse.
Suporte Financeiro: O presente trabalho não foi suportado por nenhum subsídio ou bolsa.
Proveniência e Revisão por Pares: Não comissionado; revisão externa por pares.