The diabetic foot in people on haemodialysis. An integrative review

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ABSTRACT

Introduction: Diabetes mellitus remains one of the most prevalent causes of chronic kidney disease, which, in its last stage becomes subsidiary to renal replacement therapy, such as haemodialysis. The vascular problems derived from diabetes, together with the complications of haemodialysis, can create new health problems in these patients, among which the diabetic foot stands out.

Objective: To understand and synthesise the existing scientific evidence on risk factors and nursing care of diabetic foot in haemodialysis patients.

Methodology: Following the recommendations of the PRISMA statement, an integrative review was carried out in the databases WOS, Pubmed, and SCOPUS, using the descriptors DESC/MESH: ''Diabetic Foot'', ''Foot ulcer'', ''Hemodialysis'', and ''Amputation''. Articles less than ten years old, in English and Spanish, were included.

Results: Ten articles (2 systematic reviews, 1 clinical practice guideline, and 7 observational studies) were included. The main variables that emerged were the incidence, morbidity, and mortality of diabetic foot, associated risk factors, and diabetic foot prevention and nursing care.

Conclusions: In haemodialysis patients, diabetic foot significantly increases morbidity and mortality, negatively impacting their quality of life. Factors such as peripheral arterial disease, poor foot health, and limited knowledge of the subject contribute to foot problems in these patients. Therefore, it is urgent to encourage prevention and promote self-care by patients, as these measures can potentially improve their health outcomes.

Keywords: chronic kidney disease; haemodialysis; diabetes; diabetic foot; care.

RESUMEN

El pie diabético en personas en tratamiento con hemodiálisis. Una revisión integrativa

Introducción: La diabetes mellitus se mantiene como una de las causas más prevalentes de enfermedad renal crónica, la cual, en su último estadio se hace subsidiaria de un tratamiento renal sustitutivo, como la hemodiálisis. Los problemas vasculares derivados de la diabetes unidos a complicaciones propias de la hemodiálisis pueden crear en estos pacientes nuevos problemas de salud, entre los que destaca el pie diabético.

Objetivo: Conocer y sintetizar la evidencia científica existente sobre los factores de riesgo y los cuidados de enfermería del pie diabético en los pacientes en hemodiálisis.

Metodología: Se llevó a cabo una revisión integrativa siguiendo las recomendaciones de la declaración PRISMA, en las bases de datos WOS, Pubmed y SCOPUS, empleando los descriptores DESC/MESH: ''Diabetic Foot'', ''Foot ulcer'', ''Hemodialysis'', ''Amputation''. Se incluyeron artículos con menos de 10 de antigüedad, en inglés y español.

Resultados: Se incluyeron 10 artículos (2 revisiones sistemáticas, 1 guía de práctica clínica y 7 estudios observacionales). Como principales variables emergieron la incidencia, morbilidad y mortalidad del pie diabético, los factores de riesgo asociados, y la prevención y cuidados de enfermería del mismo.

Conclusiones: En los pacientes en hemodiálisis el pie diabético supone un aumento de la morbilidad y mortalidad, con gran impacto negativo en su calidad de vida. La enfermedad arterial periférica, mala salud de los pies y conocimientos escasos sobre el tema, son factores desencadenantes de problemas en los pies de estos pacientes. Por tanto, es fundamental fomentar la prevención y promover el autocuidado por parte de los pacientes.

Palabras clave: enfermedad renal crónica; hemodiálisis; diabetes; pie diabético; cuidados.

INTRODUCTION

Chronic Kidney Disease (CKD) represents both a medical and public health problem due to its epidemic proportions, high frequency of complications, and associated costs[1,2]. CKD may progress slowly over months or years until reaching an end stage, at which point renal replacement therapy (RRT), such as dialysis or kidney transplantation, becomes necessary[3,4].

Diabetes Mellitus (DM) is a powerful risk factor for CKD. According to the Spanish Registry of Renal Patients of the Spanish Society of Nephrology, the incidence of DM in patients with Progressive Kidney Disease remains around 25%, being higher in men (66% vs 34%) and with a mean age older than 65 years[5].

Over the last three decades, the prevalence of DM has increased dramatically in countries of all income levels, bringing with it a series of associated complications such as diabetic neuropathy, diabetic nephropathy, diabetic retinopathy, poor cholesterol control, and elevated blood pressure—leading to vascular problems associated with the presence of ulcers and infections in the lower limbs (LL)[6,7].

In diabetic patients, the lifetime risk of developing foot ulcers is estimated at 15%, a percentage that increases as the disease progresses and complications worsen, including loss of functional status, infections, amputations, hospitalization, and death[8].

Diabetic Foot (DF) is considered a global health problem. According to the WHO, it is defined as "the presence of ulceration, infection, and/or gangrene of the foot associated with diabetic neuropathy and varying degrees of peripheral arterial disease (PAD), resulting from the complex interaction of different factors induced by sustained hyperglycemia"[9].

There are different degrees of LL lesions. **Table 1** shows the Meggitt-Wagner classification, which differentiates six stages of lower limb lesions and their associated characteristics, enabling identification of the degree of lesion severity[10].

Table 1. Meggitt–Wagner Classification.

GRADE	LESION	CHARACTERISTICS
0	At-risk foot. No lesion.	Calluses, bony deformities, claw toes, prominent metatarsal heads.
1	Superficial lesion.	Full-thickness skin destruction.
2	Deep lesion.	Penetrates subcutaneous fat and ligaments; bone not involved. Infected ulcer.
3	Deep lesion involving bone (osteomyelitis).	Extensive and deep; discharge present; foul odor.
4	Limited gangrene (minor amputation).	Necrosis of part of the foot (toes, heel, or plantar area).
5	Extensive gangrene (major amputation).	Entire foot affected; systemic effects.

Foot lesions in diabetic patients with CKD occur twice as often vs their non-nephropathic counterparts, with an amputation rate 3 to 6 times higher. Additionally, patients with CKD on hemodialysis (HD) have up to a fivefold higher probability of presenting foot lesions vs individuals not receiving HD treatment[11].

The DF syndrome in HD patients can create new and increasingly frequent problems within this population. Therefore, it is essential to examine foot health in the HD setting, establish appropriate care measures, and implement strategies for health promotion and prevention to improve patient quality of life[12].

Consequently, the overall objective of this integrative review was to identify and synthesize the existing scientific evidence on the risk factors and nursing care associated with DF in patients with CKD undergoing HD.

METHODOLOGY

Study Design

We conducted integrative review of studies retrieved from health sciences databases. The review followed the recommendations of the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement[13]. The search was carried out between November 2023 and February 2024.

Search Methods

The databases used for the search were Web of Science (WOS), PubMed, and SCOPUS. The search strategy employed the following DECS/MESH descriptors: "Diabetic Foot", "Foot ulcer", "Hemodialysis", "Amputation". These terms were combined using the Boolean operators "AND" and "OR".

Table 2 lists the specific search strategies used in each database.

Table 2. Literature search.

Database	Search Strategy	Total Articles	Selected Articles
PUBMED	((Diabetic foot) OR (Foot ulcer)) AND (hemodialysis)	306	5
WOS	((ALL = (Diabetic foot)) OR ALL = (Foot ulcer)) AND ALL = (hemodialysis)	163	3
SCOPUS	((Diabetic foot) OR (Foot ulcer)) AND (hemodialysis)	1,250	2
			TOTAL:10

Eligibility Criteria

Prior to conducting the search, the following inclusion and exclusion criteria were established:

Inclusion criteria:

- Original scientific articles on DF in CKD patients undergoing HD.
- Systematic reviews and clinical practice guidelines.
- Articles published between January 2014 and December 2023, in English or Spanish.

Exclusion criteria:

- Articles without full-text access.
- Narrative reviews.

Quality Assessment of the Studies

To assess the quality of the selected articles, the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist[14] was applied to observational studies, and the CASPe (Critical Appraisal Skills Programme Español) tool[15] was applied to systematic reviews.

Data Extraction

The following variables were extracted from the selected articles: author, year, country, study design, sample, objectives, main results, and quality.

Synthesis of Results

Based on the established inclusion and exclusion criteria, a total of 10 articles were selected for the development of this integrative review. A thematic–categorical approach was used due to the heterogeneity of outcomes and variables analyzed in the included studies.

RESULTS

Search Results

Once the search strategy was established in the selected databases, only articles less than 5 years old were initially considered. However, due to the limited availability of material needed to develop this integrative review, articles up to 10 years old were included.

The search and study selection process followed the PRISMA flow diagram **(figure 1).**

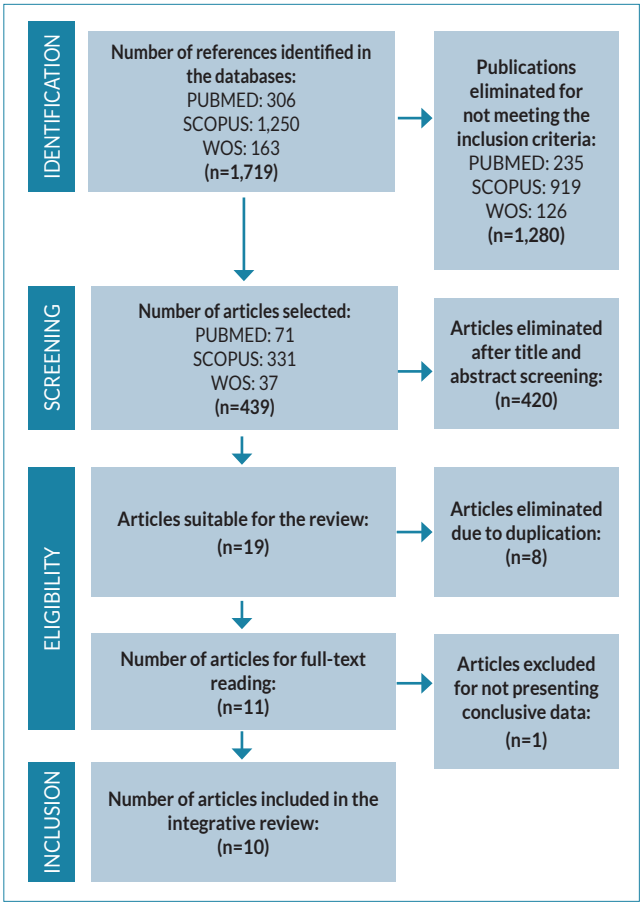

Figure 1. Flowchart of the search and selection of items.

Characteristics of the Selected Articles

Of the 10 selected articles, 2 were systematic reviews, 1 clinical practice guideline, 3 retrospective observational studies, 1 descriptive observational study, 1 prospective observational cohort study, and 2 cross-sectional observational studies. **Table 3** shows the main characteristics of the selected articles.

Table 3. Characteristics of the selected articles.

AUTHOR (YEAR), COUNTRY	STUDY TYPE	SAMPLE	OBJECTIVES	RESULTS	QUALITY
Al-Thani H, et al. (2014) Qatar[16].	Retrospective observational study.	252 patients on HD.	To analyze the incidence, risk factors, and progression of foot ulcers in patients on HD.	- Higher incidence of foot lesions (41%), major amputations (14%), and mortality (80.5%) in patients with PAD, making PAD the main risk factor for DF in diabetic HD patients. - Older age, smoking, dyslipidemia, HbA1c < 7.2, DM, and previous minor amputation were also major risk factors for DF. - Transplant patients had a lower incidence of DF development.	STROBE 19/22
Kaminski M, et al. (2019) Australia[17].	Prospective observational cohort study.	450 patients on dialysis.	To investigate risk factors for lower-limb ulcers in a dialysis cohort.	- 18% of participants developed a new ulcer. The 12-month incidence was 122 per 1000 person-years (total 211 ulcers). - 12 patients required amputations due to PAD, recurrent ulceration, or osteomyelitis. - 6 patients died from foot-related complications. - In diabetic patients without prior ulcers, nail pathology and neuropathy were significant risk factors. - In those with prior ulcers, neuropathy, PAD, and stroke were significant risk factors. - 26.4% of patients developed ulcers or had a history of ulceration/amputation.	STROBE 21/22
Kaminski M, et al. (2017) Australia[18].	Cross-sectional observational study.	450 patients on dialysis.	To investigate risk factors for lower-limb ulceration in a dialysis cohort.	- High prevalence of previous ulceration (21.6%), new ulceration (10%), and LL amputations (10.2%). - Among DF patients: 64.7% male, mean BMI 28.2, mean age 67.5 years, and 94% on HD. - Many patients used improper footwear, had poor foot care, and only half had visited a podiatrist in the last year. - Amputation and PAD increased DF risk, which decreased with higher serum albumin levels.	STROBE 20/22
Dòria M, et al. (2021) España[19].	Retrospective observational study.	220 patients on HD.	To analyze whether DF in HD patients is associated with higher morbidity and mortality compared to DM and non-DM patients.	- 38.6% of patients on HD had DM; they showed a higher rate of mortality and morbidity and the highest incidence of LL lesions. - 35.3% of diabetics had previous or current ulcers vs. 6.7% of non-diabetics.	STROBE 20/22
Lavery L, et al. (2013) Estados Unidos[20].	Descriptive observational study.	150 patients with DM on hemodialysis and 150 patients with previous ulceration.	To evaluate the incidence of foot ulcers, amputations, and hospitalizations in people with DM on dialysis compared with people with previous foot ulceration.	- 24.3% of subjects developed at least one ulcer in the lower limbs (LL), with a similar cumulative incidence in diabetic patients on dialysis and those with previous ulceration. - The amputation rate was higher in diabetic patients undergoing dialysis. - Hospital admissions due to LL lesions were higher in the dialysis group.	STROBE 19/22

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AUTHOR (YEAR), COUNTRY	STUDY TYPE	SAMPLE	OBJECTIVES	RESULTS	QUALITY
Marn-Pernat A, et al. (2016). Norteamérica[21].	Retrospective observational study.	61,292 diabetic patients on HD.	To investigate the implementation of a routine podiatry screening program in diabetic patients on HD	- Higher comorbidity in the post-implementation group due to higher rates of HTN, IHD, HF, and PAD. - Monthly podiatry screening reduced LL amputation rates, with a 1.07% amputation rate post-implementation vs. 1.2% pre-implementation. - Estimated 17% reduction in amputations.	STROBE 18/22
Schaper N, et al. (2020). Amsterdam[22].	Clinical practice guideline.	Patients with DM.	To develop an updated guideline for the prevention and treatment of diabetic foot disease.	- Activities related to prevention, management, and patient/professional education, along with multidisciplinary care and close follow-up, significantly reduced the incidence of LL ulcers.	N/A
Dòria M, et al. (2016) España[23].	Cross-sectional observational study.	92 diabetic patients on dialysis.	To evaluate the prevalence of diabetic foot and other diseases associated with DM in patients undergoing HD.	- Diabetic patients on HD had higher risk of diabetic foot and amputations. - 17.4% had DF; 53.4% developed ulcers; 19.6% ulcers + amputations; 16.3% amputations alone. - 87% had high risk of DF. - Mainly men with mean age 70 years. - 92.4% were on HD. - Cumulative incidence of amputations increased with time on HD.	STROBE 20/22
Manewell S, et al. (2023) Australia[24].	Systematic review.	212 studies.	To summarize the available evidence on prevention and treatment of lower-limb complications in dialysis patients.	- 72% of the studies focused on DF prevention and LL complication control. - 75% used surgery as main intervention. - 6% focused on healthcare professionals' roles; 5% emphasized screening. - 4% emphasized medication; 2% rehabilitation/physical therapy.	CASPE 8/10
Alshammari L, et al. (2022) Suiza[25].	Systematic review	4 studies.	To analyze the factors that facilitate or hinder the implementation of educational programs on foot care in patients receiving HD.	- The studies included in the review focused on assessing the feet of diabetic patients on HD and providing them with foot-care education. - Regarding foot assessments, 2 studies evaluated healthcare professionals. - One study found that foot evaluation improved patients' knowledge. - Two studies reported that foot examinations performed by nurses improved the frequency of foot checks, knowledge, and self-care behaviors among diabetic patients receiving HD.	CASPE 9/10

IHD: Ischemic Heart Disease, **PAD:** Peripheral Arterial Disease, **CVD:** Cerebrovascular Disease, **DM:** Diabetes Mellitus, **HbA1c:** Glycated Hemoglobin, **HD:** Hemodialysis, **HTN:** Arterial Hypertension, **CHF:** Congestive Heart Failure, **BMI:** Body Mass Index, **LL:** Lower Extremities, **DF:** Diabetic Foot.

Description of Findings

Incidence, Morbidity, and Mortality

Four of the articles analyzed the incidence and prevalence of DF in the HD population, as well as the associated morbidity and mortality[16,19,20,23].

Dòria M, et al. (2021)[19] found that mortality rates in patients receiving HD were higher in those with DM, cardiovascular disease, microvascular complications related to DM, lower-limb (LL) ulcers, and amputations. In addition, the development of a new ulcer was more frequent in patients

who had previously had an ulcer, with DF being associated with lower survival.

Lavery L, et al. (2013)[20] reported that the incidence rate of LL ulcers, amputations, and hospitalizations related to foot problems was higher in HD patients compared to the general diabetic population. However, the cumulative incidence of developing ulcers was the same between dialysis patients and those with prior ulceration but not on dialysis. These data show a higher risk of foot complications among diabetic patients receiving RRT.

Dòria M, et al. (2016)[23] included diabetic patients undergoing both types of dialysis (peritoneal dialysis and HD), although most belonged to the HD group (92.4%). The authors found that 87% of the studied population had a high risk of developing foot complications. Furthermore, the cumulative incidence of amputations increased as dialysis treatment progressed. Likewise, Lavery L et al. (2013)[20] highlighted a higher prevalence of DF syndrome in patients undergoing RRT vs the general, non-dialysis population. However, Al-Thani H, et al. (2014)[16] reported that kidney transplant recipients had a lower incidence of foot complications.

Risk Factors

Peripheral Arterial Disease (PAD)

Three articles identified PAD as a strong risk factor for developing LL complications in dialysis patients[16-18].

According to Al-Thani H, et al. (2014)[16], HD patients with PAD had a higher incidence of foot ulcers regardless of the presence of DM, and PAD was also associated with higher mortality (39% vs. 13%).

Kaminski M, et al. (2019)[17] found that in dialysis patients with a history of DF, PAD was one of the main risk factors. These authors later demonstrated that PAD was a predominant risk factor for DF development in the dialysis population, 94% of whom were on HD[18].

Previous Amputation and Previous Ulcer

Al-Thani H, et al. (2014)[16] and Kaminski M, et al. (2017)[18] reported that previous LL amputation is a major risk factor that increases predisposition to ulceration. Kaminski M, et al. (2017)[18] further established that previous ulcers and foot deformities are strong risk factors for amputation.

Foot Health

According to Kaminski M, et al. (2019)[17] and Kaminski M, et al. (2017)[18], nail pathology and the presence of foot deformities were risk factors for LL complications. Additionally, Kaminski M, et al. (2017)[18] reported that most dialysis patients did not wear appropriate footwear, did not have adequate foot health, and only half had visited a podiatrist in the past year.

Other Risk Factors

Al-Thani H, et al. (2014)[23] identified advanced age, dyslipidemia, and smoking as risk factors for DF in the HD population.

According to Kaminski M, et al. (2019)[23], diabetic neuropathy and cerebrovascular disease (CVD) were also risk factors in this population.

Kaminski M, et al. (2017)[18] additionally considered male sex, mean Body Mass Index (BMI) of 28.2, and a mean age of 67.5 years to be risk factors.

Prevention and Treatment

Four studies addressed concepts related to the prevention and treatment of DF in diabetic patients on HD[21,22,24,25].

Marn-Pernat A, et al. (2016)[21] studied the implementation of a podiatric review program in diabetic patients on HD, which significantly reduced amputation rates in this population. The study demonstrated a 17% reduction in major amputation rates among patients who participated in the program.

Schaper N, et al. (2020)[22] developed the practical guidelines of the International Working Group on the Diabetic Foot. This clinical practice guideline, consistent with Marn-Pernat A et al. (2016)[21], stated that prevention of foot lesions is based on identifying the at-risk foot, routine podiatric screening in the at-risk population, and patient–family–healthcare professional education to increase knowledge and self-protective behaviors. Depending on each patient's risk factors, the guideline stratified risk into four levels (very low, low, moderate, and high), determining the appropriate frequency of podiatric follow-up.

Regarding the treatment of diabetic ulcers, the guideline proposed several therapeutic options to be selected based on each patient's needs. These treatments included offloading and ulcer protection, restoration of tissue perfusion, infection management, metabolic and comorbidity control, local ulcer care, and again, education of the patient and family.

Manewell S, et al. (2023)[24] summarized existing evidence on the prevention and treatment of LL problems in a dialysis population. According to the study, surgery was the most common intervention. However, 10 articles also demonstrated that screening by a healthcare professional was essential, as well as perfusion pressure evaluation, measurement of the Ankle-Brachial Index (ABI), and foot examination by the dialysis nurse. Additionally, 13 studies highlighted the importance of multidisciplinary care. Other studies focused on interventions such as medication optimization, post-amputation rehabilitation, negative pressure therapy, low-density lipoprotein apheresis, or ulcer treatment in specialized wound clinics. The study concluded that recognizing the dialysis population as high-risk is fundamental for prevention, treatment, and interdisciplinary care.

In another review, Alshammari L, et al. (2022)[25] found that all included studies focused on foot-care assessment and education in HD patients. This review demonstrated that foot-care interventions in HD patients lead to positive outcomes, improving knowledge and self-care behaviors in this population.

Nursing Care

Two of the studies refer to foot care provided by nursing professionals in the HD setting[21,25].

Marn-Pernat A, et al. (2016)[21] proposed that patients with DM on HD should be included in a monthly foot examination program implemented by nursing professionals. First, nurses gathered background information related to each patient's LL problems. Afterwards, they carried out a physical examination, checking both the inside and outside of the shoes and socks. They then performed a thorough LL assessment, examining nail condition, calluses, erythema, or any sign of potential risk for developing DF. Finally, pedal pulses were palpated and a sensitivity test was performed using a monofilament. According to this study, health education provided by nurses was also considered important, and was adapted to each patient's knowledge level and needs.

Alshammari L, et al. (2022)[25] also analyzed the importance of nursing education in foot assessment, stating that the knowledge provided by nurses—through individual or group training—led to an increase in the number of patients who attended foot examinations, resulting in improved outcomes. Thus, educational activities related to foot care demonstrated significant improvements in self-care, LL examinations, patient knowledge, and complication rates affecting the lower limbs.

DISCUSSION

This integrative review demonstrates the impact of DF in patients with CKD on HD, emphasizing the risk factors that may lead to ulceration, effective prevention measures, and nursing care.

Among the findings of this review, it is clear that HD patients with DF present higher morbidity and mortality, with increased amputation rates[19,20,23]. These data are consistent with Orimoto Y, et al. (2013)[26], who identified poor prognosis in HD patients with foot lesions, showing increased mortality and amputation rates. This study, like the one included in our review by Kaminski M, et al. (2017)[18], found that increased serum albumin levels in these patients were associated with a reduced risk of developing foot lesions. Additionally, it noted that achieving permeable arterial reconstruction also decreased the risk of these lesions.

Regarding risk factors, several authors found that PAD is a predominant risk factor for LL lesions in diabetic patients undergoing HD[16-18]. However, García A, et al. (2012)[27], who analyzed PAD and DF prevalence in an HD population, found that cardiovascular disease was the most common risk factor (present in more than half of patients), while PAD accounted for 41% of the sample. PAD was identified through pulse assessment and measurement of the Ankle–Brachial Index (ABI) to accurately determine vascular insufficiency in the lower limbs. This study also highlighted that the risk of foot ulcers in HD patients is higher among diabetics due to loss of protective sensation in the LL.

Other studies noted that longer duration on HD and male sex were risk factors for DF18,[23]. However, in the study by Lechuga M, et al. (2017)[28], no significant associations were found between DF and these variables. Additionally, deformities, nail pathology, and poor foot health were considered risk factors[17,18], consistent with findings from Lechuga M, et al. (2017)[28], who reported that HD patients with nail abnormalities and foot deformities were 1.2 times more likely to develop DF than those without podiatric issues.

Another important finding is that routine foot checks, good foot health, and education on proper LL care in diabetic HD patients contribute to improved outcomes, self-care, and knowledge among at-risk patients[21,22,24,25]. These results are similar to the study by Bernal E, et al. (2009)[29], which concluded that prevention programs and appropriate patient education in HD can significantly reduce foot-related complications. Preventive measures included glycated hemoglobin control, routine examinations, peripheral pulse checks, sensitivity tests, and risk-based patient classification. The study showed that failure to thoroughly examine the feet of diabetic HD patients leads to inadequate management of complications and increased foot lesion prevalence, resulting in substantial quality-of-life deterioration. In another study by McMurray SD, et al. (2002)[30], a diabetes education program focused on self-care, follow-up, and foot examinations significantly improved patient self-management. Regarding nursing care, two studies in this review highlighted the essential role of nurses in preventing and managing DF in HD patients. They showed that implementing a foot-examination program and health education led by nurses improved patient knowledge and reduced LL complications[21,25]. Similarly, Reda A, et al. (2012)[31] found that a prevention program based on foot assessment and education by nursing staff was associated with reduced risk of LL complications during HD treatment. After implementing the program, improvements were observed in appropriate footwear use and a decrease in diabetic neuropathy prevalence.

In this regard, and to enhance nursing practice, Barnes T, et al. (2013)[32] developed a training program for nursing professionals. Ensuring nurses received proper education on HD care helped provide HD patients with adequate self-care knowledge, encouraging their active involvement in treatment and improving nurse–patient relationships.

Study Limitations

The main limitation of this review was restricted access to many articles, preventing full-text retrieval. Additionally, several studies addressed RRT in general rather than HD specifically.

Finally, no full-text articles analyzing DF in peritoneal dialysis populations were found, making it impossible to compare outcomes across dialysis modalities.

Practical Considerations

Given that prevention is the most effective measure against DF in HD patients, nurses hold significant responsibility in caring for this population. It is essential to develop preventive programs that reduce DF incidence, as well as provide appropriate health education, foot assessments, and activities promoting self-care and knowledge among diabetic HD patients. These measures ensure better health status and consequently a higher quality of life.

Based on the main findings of this review, the development of lesions and complications in the feet of diabetic HD patients with DF is associated with higher mortality and morbidity, increased amputation rates, and potentially diminished quality of life.

PAD is identified as the main risk factor, as reduced blood flow to the extremities promotes lesion development. Poor foot health, deformities, calluses or nail abnormalities, lack of podiatric visits, and insufficient knowledge also predispose patients to LL ulcers.

Enhancing self-care and increasing patient knowledge through proper health education provided by a multidisciplinary team ensures improved prevention and management of DF in HD patients, with nurses playing a central role.

Conflicts of interest

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