Sara Jiménez González.
Podiatrist. Department of Endocrinology and Nutrition. Diabetic Foot Hospital Príncipe de Asturias Hospital. Alcalá de Henares. Madrid. Spain.

Dr. José Antonio Rubio García.
Specialist. Department of Endocrinology and Nutrition. Diabetic Foot Unit. Príncipe de Asturias Hospital. Alcalá de Henares. Associate Professor in Health Sciences. Department of Medicine and Medical Specialties, UAH.

Can Diabetic Foot Be Prevented?

In our previous article, published in the last issue of this journal, we explored in depth what diabetic foot (DF) is, its consequences, and the factors involved in its development: peripheral neuropathy and/or peripheral arterial disease (PAD). We also emphasized the importance of identifying conditions that increase the risk of ulceration, even without prior lesions, which is referred to as a high-risk diabetic foot.

In this article, we will delve deeper into the key aspects of diabetic foot (DF) prevention and its consequences. Prevention can be approached in four ways:

1. Reducing the prevalence of peripheral neuropathy and PAD.

2. Reducing the occurrence of injuries in patients with high-risk DF.

3. Properly treating patients with existing lesions.

4. Reducing the risk of recurrent ulcers and maintaining optimal care for high-risk DF patients.

Therefore, we will be giving an answer to **four different questions.**

CAN WE AVOID THE APPEARANCE OF A HIGH-RISK DIABETIC FOOT?

Let us prevent the onset of neuropathy and peripheral arterial disease.

We already know that both neuropathy, with the resulting loss of protective sensation, and the presence of PAD place patients with this condition at risk for developing a foot ulcer. Both complications are **chronic and irreversible**, underscoring the importance of addressing these contributing factors to prevent them. By tackling triggering factors, we can prevent the onset or progression of these complications, as most of them are modifiable.

In the case of neuropathy, hyperglycemia is a well-known central factor, but other contributors include hypertension, lipid disorders (elevated triglycerides and LDL cholesterol), and abdominal obesity (typical in type 2 diabetes). Avoiding nerve-toxic substances like alcohol is also essential. In PAD, **smoking plays a significant role** in addition to the above-mentioned factors. Tobacco not only promotes cholesterol buildup but also has a vasoconstrictive effect, narrowing the arteries' lumen and further reducing blood flow to tissues.

Chronic complications are directly linked to the degree and duration of hyperglycemia. Good metabolic control prevents and reduces chronic complications when initiated early in the disease.

In type 1 diabetes (T1DM), effective control is more achievable from the onset, given the early age of diagnosis. However, in type 2 diabetes (T2DM), which develops later in adulthood, it often follows years of unhealthy habits and a prediabetic state. Strict glycemic control has shown greater efficacy in reducing neuropathy in T1DM, with less evidence in T2DM. Nevertheless, adopting healthy lifestyle changes and improving disease control at any stage will always yield positive results in patients' quality of life and slow the progression of complications. Besides **achieving optimal glycemic control**, maintaining **healthy lifestyle habits is essential**, including a balanced diet, regular physical activity, and avoiding harmful substances like alcohol and tobacco.

CAN THE DEVELOPMENT OF AN ULCER IN A HIGH-RISK DIABETIC FOOT BE PREVENTED?

Let us identify at-risk feet, train professionals, educate our patients, and provide podiatric care.

Adequately treating ulcers requires multidisciplinary teams in diabetic foot units. When a patient has a high-risk DF, ulceration can still be prevented. Comprehensive foot care programs—comprising education, periodic foot exams, and risk classification—have shown to reduce foot injuries by up to 50%. Therefore, we must not wait for a foot to develop an ulcer before taking action; we must act to prevent its occurrence. To achieve this, the first step is to identify a DF at risk.

High-risk DF detection should be conducted by a health care professional managing the patient's disease, such as nurses, general practitioners, endocrinologists, and podiatrists. The examination includes visual inspection, detection of protective sensation loss (PSL): using a monofilament, tuning fork, or light pressure with the index finger on the 1st, 3rd, and 5th toes (Ipswich tactile test), and palpation of arterial pulses to identify PAD. This evaluation should be conducted annually or more frequently depending on risk categorization ***(Table 1)***.

Once identified, patients at risk of DF and caregivers must be educated to enhance »

ONCE IDENTIFIED, PATIENTS AT RISK OF DIABETIC FOOT AND CAREGIVERS MUST BE EDUCATED TO ENHANCE SELF-CARE PRACTICES

» **self-care practices**. While all patients benefit from improving their knowledge regarding foot care, it is particularly in these high-risk patients where we must intensify our efforts. Self-care practices should include: (i) daily hygiene and inspection of the feet, (ii) identifying warning signs to seek help and initiate early care, (iii) using appropriate footwear (breathable socks) and selecting proper shoes, and (iv) understanding actions and techniques to avoid trauma, such as avoiding self-treatment at home.

The absence of symptoms or pain does not mean feet are healthy. Neuropathy can lead to progressive foot anesthesia without associated symptoms. Daily hygiene should also serve as an opportunity to inspect for redness, blisters, or abrasions that might otherwise go unnoticed. Minor lesions, no matter how insignificant they seem, require prompt attention. Basic first-aid steps include: cleaning wounds with soap and water, using antiseptics like chlorhexidine or povidone-iodine, protecting the wound with dressings, and avoiding pressure on the area by using footwear that does not compress the affected zone. Consulting a specialist is always recommended.

It is important to entrust the care of our feet to specialized professionals, such as podiatrists, who can perform preventive treatments that are essential for all patients with high-risk diabetic feet. Proper trimming of toenails, removal of calluses and/or hard skin, treatment of fungal infections and warts, and addressing nail deformities (thickened, ingrown nails, etc.) can prevent the development of ulcers in the following days. Podiatrists also provide orthopedic treatments through the use of custom functional plantar orthoses and prosthetics that help compensate for existing digital deformities and redistribute pressure on the foot. This prevents or reduces the appearance of pressure points and calluses, which are often the starting point of lesions.

Studies have shown that the primary trigger for a foot ulcer is wearing **inappropriate footwear**. It is extremely important to understand the minimum requirements for suitable footwear, including:

- A wide, high, and rounded toe box to allow toe mobility.
- A sole and heel counter with some rigidity to prevent the shoe from deforming easily and to provide stability to the foot.
- A wide, moderately high heel, ideally between 2 cm and 4 cm.
- Fastening mechanisms like laces, buckles, Velcro, or other systems that secure the shoe over the foot and adjust to the individual's foot shape.

Do not hesitate to consult your podiatrist to ensure your footwear is appropriate before using it for the first time. Equally important is the use of socks, an essential accessory for all diabetics. Shoes should never be worn without them. Ideally, the socks should be seamless, without tight elastic bands, and made of natural materials that allow the feet to breathe.

CAN WE ACHIEVE ULCER HEALING AND REDUCE ITS CONSEQUENCES?

Adequately treating ulcers requires the involvement of multidisciplinary teams within specialized diabetic foot units

But what **if the patient already has an ulcer?** Can **we properly treat the lesion and prevent it from worsening?** The »

Risk stratification for foot ulceration in patients with diabetes mellitus and inspection frequency (IWGDF 2023)

CATEGORY	RISK LEVEL	CHARACTERISTICS	INSPECTION FREQUENCY
0	Very Low	No LPS and no PAD	Annual
1	Low	LPS or PAD	Once every 6–12 months
2	Moderate	LPS + PAD or LPS + deformities or PAD + deformities	Once every 3–6 months
3	High	LPS or PAD with any of the following: • History of previous ulcer • History of lower-limb amputation • End-stage renal disease	Once every 1–3 months

LPS: loss of protective sensitivity; PAD: peripheral arterial disease.

EVIDENCE SHOWS THAT OUTCOMES ARE SIGNIFICANTLY BETTER WHEN PATIENTS ARE TREATED BY EXPERIENCED MULTIDISCIPLINARY TEAMS

» answer, once again, is yes. It is crucial for patients with foot lesions to consult their health care team as soon as possible to prevent progression and complications such as infection.

Scientific literature indicates that up to one-third of patients require hospitalization for foot infections, often requiring surgical treatment. In some cases, this may result in amputation, either minor (involving a toe or part of the foot below the ankle) or major (involving the ankle or more). Survival rates are lower in such patients, especially after major amputations, with a significant decrease in life expectancy within five years.

If an ulcer exhibits severe symptoms such as large size, pain, redness around the area, wound discharge, ***or skin discoloration (including gangrene), immediate evaluation by a physician, podiatrist, or nurse specializing in foot care is necessary the same day***.

Guidelines recommend that patients with uncomplicated superficial lesions, without infection or PAD can be managed in primary care. However, deeper or complicated lesions, or those that fail to heal, should be referred to a **Diabetic Foot Unit** (DFU). Typically, these units are part of hospitals and involve multidisciplinary teams, including podiatrists, endocrinologists, vascular specialists, and other disciplines, working collaboratively. DFUs address the complexity of foot lesions and manage the multiple factors affecting diabetic foot patients. Evidence shows that outcomes are significantly better when patients are treated by experienced multidisciplinary teams. Comprehensive education for patients and organized care can reduce amputation rates by 50% up to 80%, improving both the quality of life and survival of patients.

MY ULCER HAS HEALED. CAN WE DO ANYTHING ELSE?

Let us prevent recurrence and control excess cardiovascular risk.

All high-risk DF patients, as well as those with a history of ulcers (the highest-risk group), require lifelong preventive podiatric care to avoid recurrence, a concept known as maintaining the diabetic foot in remission. One major challenge is that **preventive podiatric care** is not widely available and is often financially borne by the patient. In many cases, such care is not covered by public health systems, or if it is, the coverage is minimal. In the future, we hope these preventive measures will become standardized within health programs and accessible to all individuals with diabetes and at-risk feet.

It is also important to note that in DF patients, the problem is not limited to ulcers. These patients face higher mortality rates and a greater number of associated comorbidities. Therefore, it is essential to address the factors contributing to increased cardiovascular risk more aggressively.

In conclusion, diabetic foot is a potentially devastating complication. However, we have extensive knowledge about how it develops and what can be done to prevent it:

(i) We can prevent neuropathy or PAD in people with diabetes.

(ii) In patients with at-risk feet, we can prevent ulcers, primarily through podiatric care and appropriate footwear.

(iii) If a patient already has an ulcer, we can treat it effectively to reduce the risk of lower-limb amputation. Having access to a DFU for management not only saves limbs but also improves patient outcomes and life expectancy. D

REFERENCES

- International Working Group on the Diabetic Foot. IWGDF Guidelines on the prevention and management of diabetes-related foot disease [accedido el 30 de marzo de 2024]. Disponible en: https://iwgdfguidelines.org/guidelines-2023/all-guidelines-2023/
- Ministerio de Sanidad. Abordaje del pie diabético. Estrategia de Diabetes del Sistema Nacional de Salud. Edita y distribuye: © Ministerio de Sanidad. Centro de publicaciones. Paseo del Prado, 18 - 28014 Madrid. NIPO en línea: 133-22-045-9. 2022. [accedido el 28 de marzo de 2024] Disponible en: https://cpage.mpr.gob.es/producto/abordaje-al-pie-diabetico/
- Lázaro-Martínez, JL. La mejor prevención es un calzado adecuado. Revista de Diabetes 2013, nº 20, pág 42-43.
- Díaz Pérez, JA. Autocuidado del pie diabético. [accedido el 29 de marzo de 2024]. Disponible en: https://www.sediabetes.org/pacientes/materiales/