DIABETIC FOOT CASE REPORT

Luca Dalla Paola MD
Diabetic Foot Unit
Maria Cecilia Hospital
GVM Care & Research
www.piedediabetico.eu

Past President
International Association of Diabetic Foot Surgeons

EPIDEMIOLOGY

- **The Diabetic foot constitutes a tremendous challenge for patients, caregivers and health care systems**
- **During their lifetime one in seven diabetic patients develops foot ulcers which are highly susceptible to infection**

- **85% of amputations are preceeded by an ulcer**
- **The diabetic foot treatment expenses absorb about 40% of overall hospital budget for diabetes**

Lavery L.A. et al., Diabetes Care, 19:48, 1996

Maria Cecilia Hospital
Cotignola
GVM
CARE & RESEARCH

-DFI treatment accounts for up to one-quarter of all diabetic admissions in both Europe and the United States making it the single **most common reason for DM-related hospital admission.**

-Approximately two third of lower extremity amputations are the result of an infected ulcer

-Surgery as a part of a multidisciplinary approach is a key in the management of many types of diabetic foot infections (DFIs)

Pecoraro RE *Diabetes Care* 1990
Apelqvist J et al *Foot Ankle Int 1995*
Armstrong DG *Diabetes Care* 1998
Boulton AJ et al *Wound Repair Regen 1999*
Lipsky BA et al *Clin Infect Dis 2004*
Lavery LA et al *Diabetes Care 2006*

Maria Cecilia Hospital Cotignola GVM CARE & RESEARCH

International Journal of Infectious Diseases 40 (2015) 81–91

Contents lists available at ScienceDirect

International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijid

Review

Diabetic foot infections: what have we learned in the last 30 years?

Ilker Uçkay [a,b,*], Javier Aragón-Sánchez [c], Daniel Lew [a], Benjamin A. Lipsky [a,d]

Table 1
Key changes in the knowledge and management of diabetic foot infections in the last 30 years—summary of the authors' views

Research field	1985	2015
Pathogens	Methicillin-susceptible *Staphylococcus aureus*, streptococci, *Enterobacteriaceae*	More multidrug-resistant organisms (MRSA, ESBLs) Predominance of Gram-negative pathogens in (sub)tropical climates
Microbiological diagnosis	Standard cultures, usually of swab specimens	Aerobic and anaerobic cultures of tissue specimens (soft tissue and bone) Molecular microbiology (e.g., PCR) Metagenomics
Imaging	Plain X-rays; scintigraphy (bone, leukocyte scans)	MRI; SPECT/CT; PET/CT
Antibiotic agents	Penicillins; 1st to 3rd generation cephalosporins; some 2nd generation fluoroquinolones	4th/5th generation cephalosporins; carbapenems; 3rd/4th generation fluoroquinolones; linezolid; daptomycin
Route of administration and site of treatment	Initial (sometimes prolonged) intravenous administration, usually in hospital	Mostly oral (sometimes after a brief intravenous course), even in the presence of vascular disease or osteomyelitis; some topical; outpatient except for severe infections or complex treatments
Spectrum of antibiotic therapy	Relatively broad (directed at Gram-positive and Gram-negative pathogens)	Very broad empiric therapy for severe infections; more targeted for mild/moderate infections and for definitive therapy
Duration of antibiotic therapy	Many weeks for soft tissue infections; ≥6–12 weeks for bone	1–2 weeks for soft tissue infections; 4–6 weeks for osteomyelitis
Surgical approach	Aggressive (ablative) therapeutic surgery; inpatient treatment	More conservative (tissue sparing) therapeutic (even for osteomyelitis) and preventive surgery; corrective surgery; often in outpatient facilities and specialized diabetic foot centres
Revascularization	Open vascular surgery	More percutaneous angioplasty and distal bypasses, including infragenicular
Management guidelines	Mostly individual, empirical approaches Individual recommendations and practices on the hospital level	Clinical guidelines based on systematic reviews; multidisciplinary teams, especially including podiatry; clinical pathways; some behavioural sciences national guidelines; validation of guidelines
Adjunctive treatments	Stimulation with growth factors; platelet-rich products; larval biotherapy (maggots)	Hyperbaric oxygen therapy; granulocyte-stimulating factors; research in stem cell and bacteriophage therapies; microbiome concepts
Dressing	Simple dressings, with separate use of disinfection agents	More hydrofibre and silver-containing dressings; studies with topical antibiotics embedded in dressings
Scientific publications	Mostly case series	More prospective randomized trials, multicenter studies, and evidence-based (Cochrane) meta-analyses

ESBL, extended-spectrum beta-lactamase; MRI, magnetic resonance imaging; MRSA, methicillin-resistant *Staphylococcus aureus*; PET/CT, positron emission tomography/computed tomography; SPECT/CT, single photon emission computed tomography/computed tomography.

CASE HISTORY

- F.F. Male 78 yrs old
- Type 2 Diabetes (insulin/Dapaglifozin)
- Stroke (2004)
- CHD (CABG 2023)
- Atrial Fibrillation (rivaroxaban)
- Diabetic Retinopathy (vitrectomy 2018)
- Charcot Neuroarthropathy class 2 Frykberg & Sanders left foot (midfoot fusion 2022)

CASE HISTORY

- December 2023 a new lesion on the plantar aspect right hindfoot
- Admitted January 29 2024 in DF Department MCH Cotignola Italy

Maria Cecilia Hospital
Cotignola
GVM
CARE & RESEARCH

Differential Diagnosis:

Osteomyelitis?

Acute Charcot Neuroarthropahty class 5?

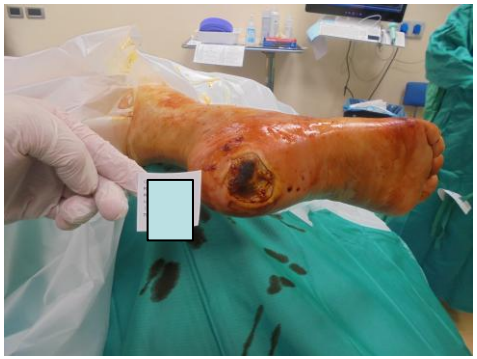
Maria Cecilia Hospital
Cotignola
GVM
CARE & RESEARCH

Vascular Assessment at Hospital Admission

- $TcPO_2$ right foot 19 mmHg
- Duplex Scanning: occlusion of Anterior and Posterior Tibial Arteries

Surgical Procedure (1) January 30th 2024

- Surgical debridement of soft tissue
- Exposition of calcaneal fracture
- Bone biopsy for micro and histo evaluation
- Microbiological results on bone biopsy:
  - **Proteus mirabilis**
  - **Staph epidermidis MR**
  - **Enterococcus faecalis**



AngioPTA January 31 2024

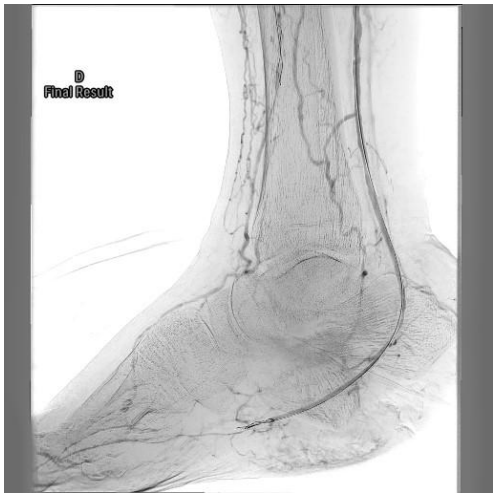
- Extensive BTK disease

Maria Cecilia Hospital
Cotignola
GVM
CARE & RESEARCH

UNIVERSITÀ DEGLI STUDI DI FERRARA

AngioPTA January 31st 2024

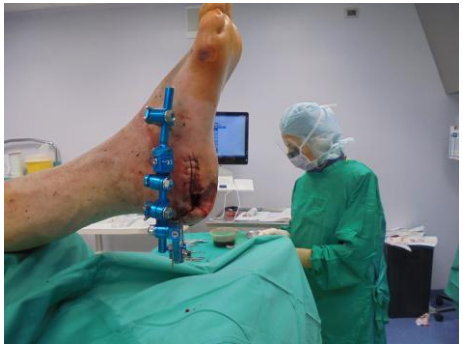
- PTA posterior tibial artery and plantar artery
- PTA proximal anterior tibial artery (ineffective treatment in distal artery)



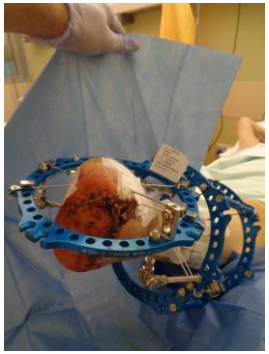
Maria Cecilia Hospital
Cotignola
GVM
CARE & RESEARCH

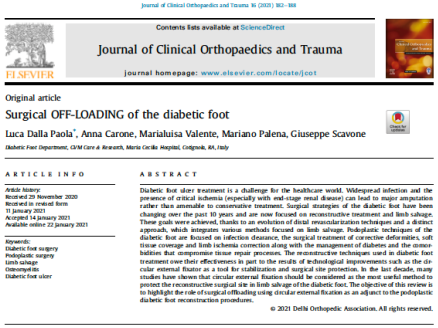
Surgical Procedure (2) February 1st 2024

- Calcanear wedge osteotomy
- Reduction of the fracture and application of ALBS
- Stabilization of the hindfoot with external fixation
- After bleeding control NPWT plus antiseptic (polyhexanide) instillation has been started



Maria Cecilia Hospital
Cotignola
GVM
CARE & RESEARCH





Journal of Clinical Orthopaedics and Trauma 16 (2021) 182–188

Contents lists available at ScienceDirect

Journal of Clinical Orthopaedics and Trauma

journal homepage: www.elsevier.com/locate/jcot

Original article

Surgical OFF-LOADING of the diabetic foot

Luca Dalla Paola*, Anna Carone, Marialuisa Valente, Mariano Palena, Giuseppe Scavone

Diabetic Foot Department, GVM Care & Research, Maria Cecilia Hospital, Cotignola, RA, Italy

ARTICLE INFO

Article history:
Received 29 November 2020
Received in revised form
11 January 2021
Accepted 14 January 2021
Available online 22 January 2021

Keywords:
Diabetic foot surgery
Podoplastic surgery
Limb salvage
Osteomyelitis
Diabetic foot ulcer

ABSTRACT

Diabetic foot ulcer treatment is a challenge for the healthcare world. Widespread infection and the presence of critical ischemia (especially with end-stage renal disease) can lead to major amputation rather than amenable to conservative treatment. Surgical strategies of the diabetic foot have been changing over the past 10 years and are now focused on reconstructive treatment and limb salvage. These goals were achieved, thanks to an evolution of distal revascularization techniques and a distinct approach, which integrates various methods focused on limb salvage. Podoplastic techniques of the diabetic foot are focused on infection clearance, the surgical treatment of corrective deformities, soft tissue coverage and limb ischemia correction along with the management of diabetes and the comorbidities that compromise tissue repair processes. The reconstructive techniques used in diabetic foot treatment owe their effectiveness in part to the results of technological improvements such as the circular external fixator as a tool for stabilization and surgical site protection. In the last decade, many studies have shown that circular external fixation should be considered as the most useful method to protect the reconstructive surgical site in limb salvage of the diabetic foot. The objective of this review is to highlight the role of surgical offloading using circular external fixation as an adjunct to the podoplastic diabetic foot reconstruction procedures.

EXTERNAL FIXATION

- External fixation for midfoot/hindfoot reconstruction and stabilization offers a versatile alternative when internal fixation is not feasible
- The use of transosseous wires provides increased stability with compression of the desired osteotomy and/or joints to obtain bone healing while allowing total offloading of the surgical site
- At the same time immediate partial weight bearing status in certain cases is allowed
- The surgical site is easily inspected

Maria Cecilia Hospital
Cotignola
GVM
CARE & RESEARCH

UNIVERSITÀ DEGLI STUDI DI FERRARA

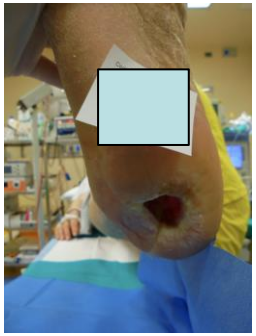
Surgical Procedure (3) february 27th 2024

- Surgical debridement
- Application of dermal substitute

Maria Cecilia Hospital
Cotignola
GVM
CARE & RESEARCH

Surgical Procedure (4) May 27th 2024

- Autologous skin graft

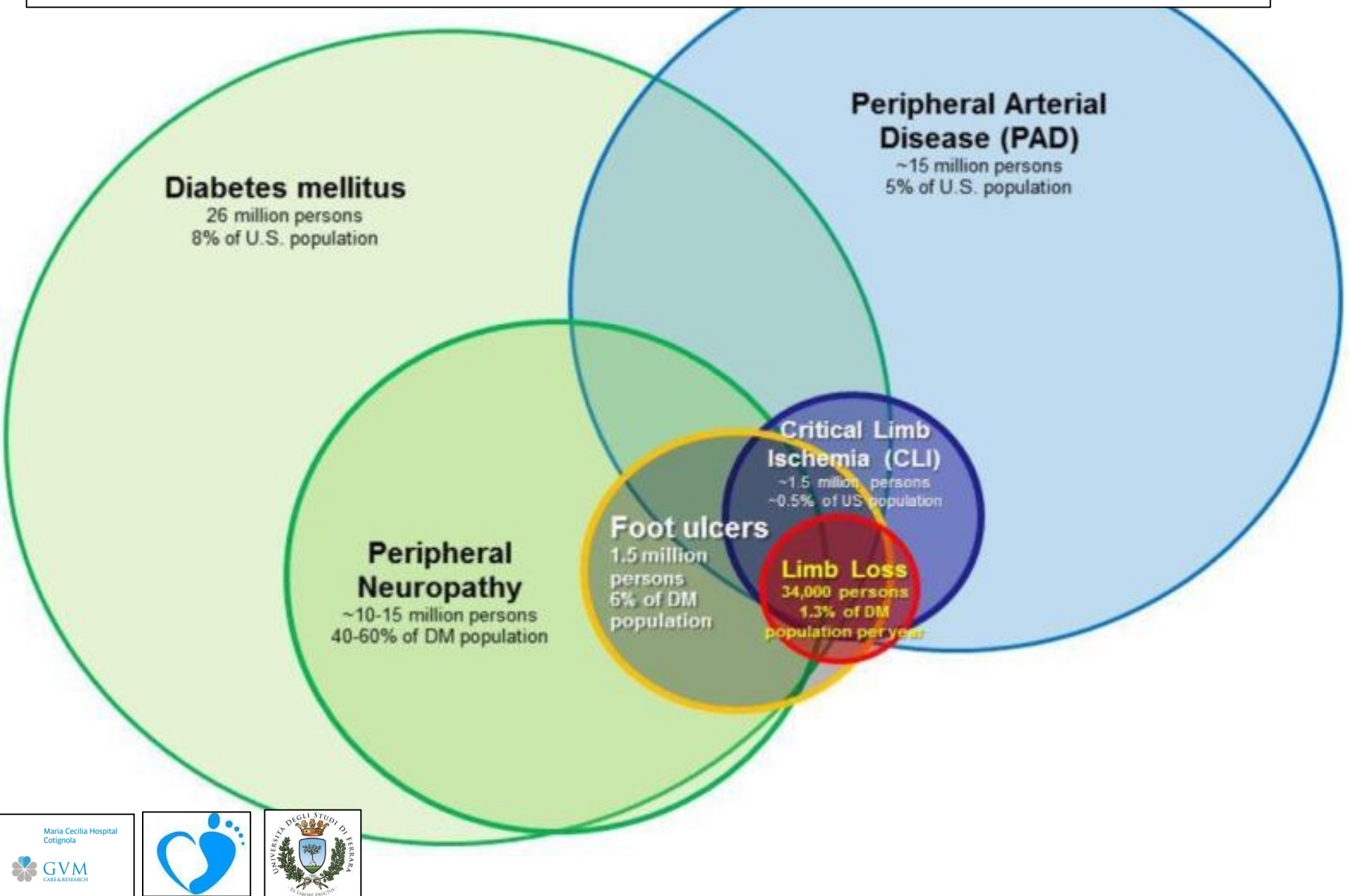


Secondary Prevention Protocol from july 2024

Maria Cecilia Hospital
Cotignola
GVM
CARE & RESEARCH

Take Home Messages

THE OVERLAPPING RELATIONSHIP OF RISK FACTORS ASSOCIATED WITH NON-TRAUMATIC LIMB LOSS IN THE US. ESTIMATES OF TOTAL AFFECTED US POPULATION, US PREVALENCE AND ANNUAL INCIDENCE RATES ARE SHOWN



Maria Cecilia Hospital
Cotignola
GVM CARE & RESEARCH

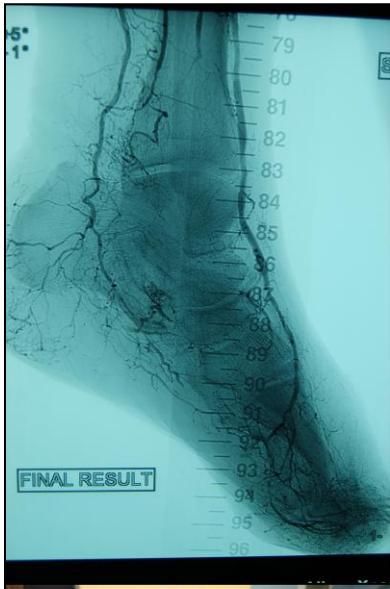
Current Diabetes Reviews, 2006, *2*, 431-447

Treatment of Diabetic Foot Ulcer: An Overview Strategies for Clinical Approach

Luca Dalla Paola* and Ezio Faglia[ψ]

Keypoints for avoiding amputations

- **Relief of plantar pressure in the treatment of neuropathic plantar ulcer**
- **Revascularisation procedures**
- **Emergent treatment of infected diabetic foot**
- **Surgery of the chronic diabetic foot (ostemyelitis)**
- **Surgery of instability and deformity (Neuropathic foot/Charcot foot)**
- **Advanced local therapy (NPWT, Bioengineered tissues, exfix)**
- Patient education and compliance
- Diabetes control
- Control of CV risk factors



Maria Cecilia Hospital Cotignola

GVM CARE & RESEARCH

- Heel ulcers result from a combination of chronic pressure, neuropathy, and PVD

- Unlike lesions located at forefoot and midfoot levels, **hindfoot and calcaneal lesions have a poor healing rate even in the case of sufficient vascular supply and consecutive to aggressive debridement associated with adequate antibiotic therapy**

- Despite difficulties in obtaining a successful conservative treatment, several clinical studies have shown the possibility to obtain limb salvage

Randall DB, Philips J, Ianiro G. Partial calcanectomy for the treatment of recalcitrant heel ulcerations. J Am Podiatr Med Assoc 2005;95:335–41.

Crandall R, Wagner F. Partial and total calcanectomy: a review of thirty-one cases over a ten year period. J Bone Joint Surg Am 1981;63:152–5.

Smith DG, Stuck RM, Ketner L, Sage RM, Pinzur MS. Partial calcanectomy for the treatment of large ulcerations of the heel and calcaneal osteomyelitis. An amputation of the back of the foot. J Bone Joint Surg Am 1992;74:571–6.

Baravarian B, Menendez MM, Weinheimer DJ, Lowery C, Kosanovich R, Vidt L. Subtotal calcanectomy for the treatment of large heel ulceration and calcaneal osteomyelitis in the diabetic patient. J Foot Ankle Surg 1999;38:194–202.

Bollinger M, Thordarson DB. Partial calcanectomy: an alternative to below knee amputation. Foot Ankle Int 2002;23:927–32.

Kerstein M. Heel ulcerations in the diabetic patient. Wounds 2002;14:212–6.

Treiman GS, Oderich SC, Ashrafi A, Schneider PA. Management of ischaemic heel ulceration and gangrene: an evaluation of factors associated with healing. J Vasc Surg 2000;31:1110–18.

Younes NA, Albsoul AM, Awad H. Diabetic heel ulcers: a major risk factor for lower extremity amputation. Ostomy Wound Manage 2004;50: 50–60.

Cevera JJ, Bolton LL, Kerstein MD. Options for diabetic patients with chronic heel ulcers. J Diabetes Complications 1997;11:358–366.

Clinical and Translational Research

Combination of Open Subtotal Calcanectomy and Stabilization With External Fixation as Limb Salvage Procedure in Hindfoot-Infected Diabetic Foot Ulcers

The International Journal of Lower Extremity Wounds
1–6

DOI: 10.1177/1534734616667865
ijl.sagepub.com
SAGE

Luca Dalla Paola, MD[1], Anna Carone, MD[1], Giulio Boscarino, MD[1], Giuseppe Scavone, MD[1], and Lucian Vasilache, MBBS[1]

(a)

(b)

Table 1. Characteristics of the Population Studied.

Characteristics	Total Population (N = 18)
Male/female, n	17/1
Type 1/2 DM, n	1/17
Age (years), mean ± SD	65.7 ± 8.2
CHD (history), n (%)	13 (72.2)
GFR (mL/min)	
>90	4
60>89	4
30>59	8
<30	2
Wound stage III TUC, n (%)	18 (100)
Mean wound area (cm^2), mean ± SD	6.7 ± 4.1
PVD, n (%)	13 (72.2)
PTA, n (%)	10 (55.6)
Bypass, n	0

Abbreviations: DM, diabetes mellitus; CHD, coronary heart disease; GFR, glomerular filtration rate; TUC, Texas University Classification; PVD, peripheral vascular disease; PTA, percutaneous transluminal angioplasty.

Inclusion criteria were the following:

1. Ulcer area ≥4 cm^2
2. Score lesion IIIB-D using University of Texas Classification
3. Clinical evidence of soft tissues infection
4. MRI/SPECT-CT (magnetic resonance imaging/single-photon emission computed tomography) positive for calcaneal osteomyelitis
5. Transcutaneous oxygen pressure measured on foot ≥30 mm Hg.

Maria Cecilia Hospital
Cotignola
GVM CARE & RESEARCH

UNIVERSITÀ DEGLI STUDI DI FERRARA
EX LABORE FRUCTUS

CONCLUSIONS

- DFO require rapid multidisciplinary team assessment.
- Use of bone culture, histology, MRI is recommended, but osteomyelitis can be difficult to objectively diagnose.
- Osteomyelitis is not an indication for primary amputation
- Spreading or deep diabetic foot infections likely require surgical inpatient management
- The goal of therapy is to prevent amputation and to preserve as much of the weight bearing surface as possible.
- Vascular assessment and liberal revascularization are imperative to a successful outcome in treating a diabetic foot infection.

Thank you for your attention