B|BRAUN
SHARING EXPERTISE

Diabetic Foot Ulcers

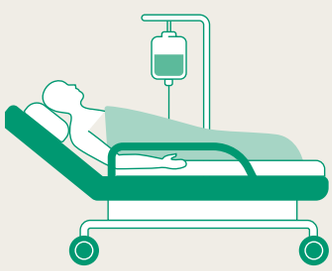
Infection management guide

DFU Management

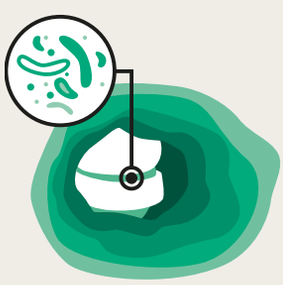
Did you know these key facts about diabetic foot?

Approximately 1/3 of people with **diabetes** will **develop a DFU** during their lifetime.[1]

More than half of such diabetic foot ulcers become infected.[2]

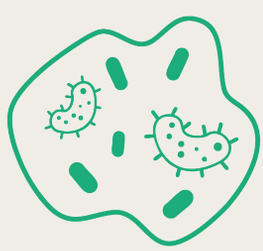


20 % of DFU infections will require hospitalization.[1]



Osteomyelitis occurs in up to **60 %** of severely infected DFUs.[3]

Biofilm is present in **78 %** of diabetic foot ulcers.[4]



Biofilm poses a threat in connection with diabetic foot ulcers because it can release bacteria and it strongly increases the risk of infection – particularly in deep ulcers and those located near sensitive structures such as tendons, joint capsules, or bone.[5,6]

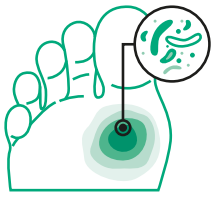
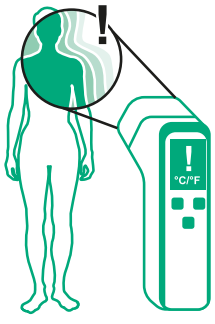
The management of diabetic foot ulcers is based on **5 basic pillars**:[7]

1. Infection management
2. Perfusion restoration in patients with ischemia
3. Offloading
4. Debridement and exudate control
5. Metabolic monitoring

Infection in DFU and classification[8]

Infection is the main cause of hospital admissions. DFU infection increases healthcare costs and length of hospital stay and is associated with high rates of amputation and mortality.

Diagnosis is mainly based on clinical examination, including signs of inflammation, analysis of inflammatory biomarkers, probe-to-bone testing and imaging tests. The severity of diabetic foot infections is classified according to the IWGDF/IDSA classification:

IWGDF/IDSA classification		Description	Clinical approach[6]
	1/Uninfected	No systemic or local symptoms or signs of infection.	Cleanse with wound cleansing solutions and debride.
	2/Mild	Infected: At least two of these conditions are present: local swelling or induration; erythema >0.5 but <2 cm around the wound; local tenderness or pain; local increased warmth; purulent discharge.	Cleanse with wound cleansing solutions, debride and apply silver dressings to control local infection. Treat with systemic antibiotics (oral agents).
	3/Moderate *add "O" if osteomyelitis is present*	Infection with no systemic manifestations. Involving: erythema extending ≥2 cm from the wound margin, and/or affected tissue deeper than skin and subcutaneous tissues (e.g., tendon, muscle, joint, and bone).	Refer patient to multidisciplinary diabetic foot care teams. Treat with systemic antibiotics (oral/parenteral). Surgical debridement if it is needed.
	4/Severe *add "O" if osteomyelitis is present*	Any foot infection ≥2 cm with associated systemic manifestations, such as: temperature >38°C or <36°C; heart rate >90 beats/min; respiratory rate >20 breaths/min or PaCO2 < 4.3 kPa (32 mmHg); white blood cell count >12,000/mm3 or < 4 G/L, or >10% immature (band) forms.	Refer to multidisciplinary diabetic foot care teams. Treat with systemic antibiotics (parenteral). Surgical debridement if it is needed.

Diabetic foot osteomyelitis should always be ruled out. Consider using a combination of probe-to-bone testing, plain X-rays, and ESR or CRP or PCT as the initial studies.

Cultures should only be taken from clinically infected ulcers and should never be used as a diagnostic method. Conventional cultures should be performed to allow for antibiograms to guide antibiotic therapy selection.

Diabetic foot ulcers should not be treated with antibiotics unless they are clinically infected, and antibiotic treatment should never be based solely on the results of microbiological cultures.[8]

How to help prevent infection and promote ulcer healing in 4 steps:[6]

1 Therapeutic wound cleansing

Clean the wound using cleansing solutions that contain surfactant agents to help break down and remove biofilm. Solutions containing polyhexanide and betaine have shown beneficial effects in disrupting biofilm and improving wound pH.

- It is recommended to apply the cleansing solution for approximately 5 minutes using soaked compresses.
- Follow this with gentle brushing of the wound bed to rinse the area thoroughly and prepare it for debridement of non-viable tissue.

2 Debridement of non-viable tissue

Sharp debridement is the preferred method for treating diabetic foot ulcers. This involves the use of a scalpel, scissors, or curette to remove necrotic tissue until slight bleeding is observed, indicating viable tissue. The effectiveness of this procedure is enhanced by prior application of cleansing agents such as Prontosan®.

B. Braun solutions for DFU treatment

Prontosan® Wound Irrigation Solution

A wound irrigation solution used for rinsing, cleansing, moistening and decontaminating acute and chronic wounds. The Prontosan® family of products contains polyhexanide (PHMB) and betaine, which help achieve optimal wound bed preparation by removing barriers to healing, such as slough, necrotic tissue, and biofilm.[9,10,11]

Prontosan® Wound Gel

A wound gel for acute and chronic wounds that provides long-lasting cleansing, moistening and decontamination of the wound bed between dressing changes.[12]
This fluid gel is useful for deep or tunneling wounds, wound cavities, and difficult-to-access areas.

Prontosan® Wound Gel X

A viscous wound gel for acute and chronic wounds that provides long-lasting cleansing, moistening and decontamination of the wound bed between dressing changes.[12]
This thicker formulation makes it suitable for large surface area wounds, including burns.[13]

Prontosan® Debridement Pad

A microfiber pad designed for soft mechanical debridement of slough and debris from wounds. Its teardrop-shaped design features a tapered end for difficult-to-access areas and a round end for larger areas.

3 Reduce bacterial load

The use of silver dressings prevents biofilm reformation and reduces bacterial load.

B. Braun solutions for DFU treatment

Askina® Calgitrol® Paste

A soft paste ionic silver alginate dressing specifically formulated for the treatment of chronic wounds that are infected or at high risk of infection, offering broad antimicrobial effectiveness.[14,15]
Its paste form provides high conformability even in tunnels and sinuses.[16]

Askina® Calgitrol® Ag+

A wound dressing that combines silver nanoparticles with hydrofibers to manage wound infection and exudate. In contact with wound exudate, the dressing responds by forming a gel which retains the bacteria and removes them when the dressing is changed.

4 Control exudate

Use suitable dressings such as alginate or superabsorbent wound dressings for effective control of wound exudate. Excessive moisture can lead to maceration of surrounding skin and delay healing.

B. Braun solutions for DFU treatment

Askina® Carbosorb

A super absorbent wound dressing with activated charcoal, designed for the management of heavy, high-viscosity exudates, as well as malodorous wounds.

Askina® DresSil Active

A multilayer silicone dressing designed for active exudate management, improving retention and absorption while maintaining the adequate moisture level in the wound.[17]

Askina® Sorb

Highly conformable and absorbent alginate-CMC wound dressing, suited for the management of moderate to heavily exuding wounds.

Discover our full range of wound care solutions

B. Braun Avitum AG | 34209 Melsungen | Germany
Phone +49 5661 710 | www.bbraun.com

Ordering Information

Product	Size	B. Braun Code	Quantity
Prontosan® Wound Irrigation Solution	350 ml	400403	1
Prontosan® Wound Irrigation Solution	40 ml	400412	24
Prontosan® Wound Gel	30 ml	400505	1
Prontosan® Wound Gel X	50 g	400517	1
Prontosan® Wound Gel X	250 g	400508	1
Prontosan® Debridement Pad	-	3908456	3
Prontosan® Debridement Pad	-	3908457	10
Askina® Calgitrol® Paste	15 g	7211598	5
Askina® Calgitrol® Paste	15 g	7211599	10
Askina® Calgitrol Ag +	5 x 5 cm	SFM6210510	10
Askina® Calgitrol Ag +	4 x 10 cm	SFM6210410	10
Askina® Calgitrol Ag +	10 x 10 cm	SFM6211010	10
Askina® Calgitrol Ag +	15 x 15 cm	SFM6211510	10
Askina® Calgitrol Ag +	2 x 45 cm	SFM6214505	5
Askina® Carbosorb	10 x 10 cm	WIN9025006	10
Askina® Carbosorb	10 x 20 cm	WIN9025014	10
Askina® Carbosorb	15 x 15 cm	WIN9025007	10
Askina® Sorb	6 x 6 cm	WIN2115S	10
Askina® Sorb	10 x 10 cm	WIN2116S	10
Askina® Sorb	3 x 30 cm	WIN2105S	10
Askina® Sorb	15 x 15 cm	WIN2102S	10
Askina® DresSil Active	7.5 x 7.5 cm	WIN5397510	10
Askina® DresSil Active	10 x 10 cm	WIN5391010	10
Askina® DresSil Active	12.5 x 12.5 cm	WIN5391110	10
Askina® DresSil Active	15 x 15 cm	WIN5391510	10

References

1. Armstrong DG, Boulton AJM, Bus SA. Diabetic Foot Ulcers and Their Recurrence. N Engl J Med. 2017 Jun 15;376(24):2367-2375
2. Prompers L, Huijberts M, Apelqvist J, Jude E, Piaggesi A, Bakker K, Edmonds M, Holstein P, Jirkovska A, Mauricio D, Ragnarson Tennvall G, Reike H, Spraul M, Uccioli L, rbancic V, Van Acker K, van Baal J, van Merode F, chaper N. High prevalence of ischaemia, infection and erious comorbidity in patients with diabetic foot disease in Europe. Baseline results from the Eurodiale study. iabetologia. 2007 Jan;50(1):18-25. doi: 10.1007/s00125-006-0491-1. Epub 2006 Nov 9. PMID: 17093942.
3. Lázaro Martínez JL, García Álvarez Y, Tardáguila-García A, García Morales E. Optimal management of diabetic foot osteomyelitis: challenges and solutions. Diabetes Metab Syndr Obes. 2019 Jun 21;12:947-959. doi: 10.2147/DMSO.S181198. PMID: 31417295; PMCID: PMC6593692.
4. Malone M, Bjarnsholt T, McBain AJ, James GA, Stoodley P, Leaper D, Tachi M, Schultz G, Swanson T, Wolcott RD. The prevalence of biofilms in chronic wounds: a systematic review and meta-analysis of published data. J Wound Care. 2017 Jan 2;26(1):20-25. doi: 10.12968/jowc.2017.26.1.20. PMID: 28103163.
5. Alves PJ, Barreto RT, Barrois BM, Gryson LG, Meaume S, Monstrey SJ. Update on the role of antiseptics in the management of chronic wounds with critical colonisation and/or biofilm. Int Wound J. 2021 Jun;18(3):342-358. doi: 10.1111/iwj.13537. Epub 2020 Dec 13. PMID: 33314723; PMCID: PMC8244012.
6. Based on personal expert opinion by Dr. Prof. José Luis Lázaro, Head of Diabetic Foot Ulcers Unit, Universidad Complutense de Madrid
7. Schaper NC, van Netten JJ, Apelqvist J, Bus SA, Fitridge R, Game F, Monteiro-Soares M, Senneville E; IWGDF Editorial Board. Practical guidelines on the prevention and management of diabetes-related foot disease (IWGDF 2023 update). Diabetes Metab Res Rev. 2024 Mar;40(3):e3657
8. Senneville É, Albalawi Z, van Asten SA, Abbas ZG, Allison G, Aragón-Sánchez J, Embil JM, Lavery LA, Alhasan M, Oz O, Uçkay I, Urbančič-Rovan V, Xu ZR, Peters EJG. IWGDF/IDSA Guidelines on the Diagnosis and Treatment of Diabetes-related Foot Infections (IWGDF/IDSA 2023). Clin Infect Dis. 2023 Oct 2:ciad527.
9. Atkin L, Stephenson J, Cooper DM. Wound bed preparation: a case series using polyhexanide and betaine solution and gel-a UK perspective. J Wound Care. 2020 Jul 2;29(7):380-386. doi: 10.12968/jowc.2020.29.7.380. PMID: 32654602.
10. Bellingeri A, Falciani F, Traspedini P, Moscatelli A, Russo A, Tino G, Chiari P, Peghetti A. Effect of a wound cleansing solution on wound bed preparation and inflammation in chronic wounds: a single-blind RCT. J Wound Care. 2016 Mar;25(3):160, 162-6, 168. doi: 10.12968/jowc.2016.25.3.160. PMID: 26947697.
11. Oropallo A, Rao AS, Del Pin C, Ranire-Maguire M, Mathew A. An objective comparative study of non-surgical cleansing techniques and cleanser types in bacterial burden management. Int Wound J. 2024 Feb;21(2):e14730. doi: 10.1111/iwj.14730. PMID: 38332560; PMCID: PMC10853581.
12. Durante CM, Greco A, Sidoli O, Maino C, Gallarini A, Ciprandi G. Evaluation of the effectiveness of a polyhexanide and propyl betaine-based gel in the treatment of chronic wounds. Minerva Chir. 2014 Oct;69(5):283-92. PMID: 25267019.
13. De Decker I, Janssens D, De Mey K, Hoeksema H, Simaey M, De Coninck P, Verbelen J, De Pessemier A, Blondeel P, Monstrey S, Claes KE. Assessing antibacterial efficacy of a polyhexanide hydrogel versus alginate-based wound dressing in burns. J Wound Care. 2024 May 2;33(5):335-347. doi: 10.12968/jowc.2024.33.5.335. PMID: 38683776.
14. Nicodeme M, Cheron M, Kriegel I, Jaimes H, Fromantin I. A silver alginate paste dressing in the management of non-malignant wounds with signs of infection in oncology patients: an observational prospective case series. Wounds International 2021; 12 (3): 70-7.
15. Zone of Inhibition Testing of Askina Calgitrol Paste (internal report ref. HOSP 247A).
16. Chadwick P. Using Askina® Calgitrol® Paste in the treatment of diabetic foot infection: case studies. London: Wounds International, 2013.
17. Data on file: Report no. HOSP 826.

This guideline has been developed in collaboration with Dr. Prof. José Luis Lázaro, Head of Diabetic Foot Ulcers Unit, Universidad Complutense de Madrid.