



International
Diabetes
Federation

Diabetic foot infection

Clinical diagnosis of DFI

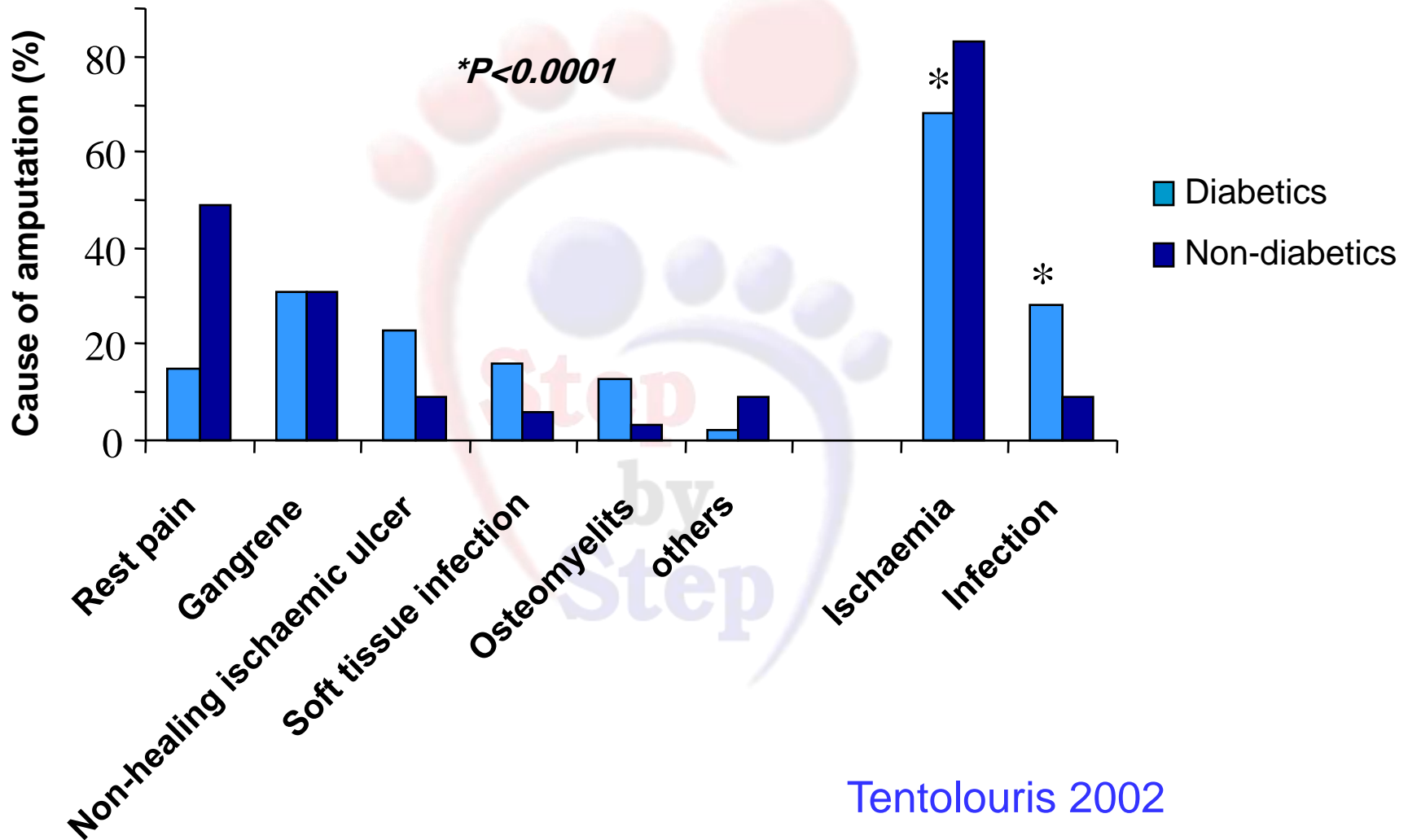
Stephan Morbach, MD
Department of Diabetes and Angiology
Marienkrankenhaus gGmbH
Soest, Germany

s.morbach@mkh-soest.de

Diabetes, infection and amputation

- **Up to 30%** of diabetic patients with a foot ulcer will eventually require an amputation, of which **60%** are preceded by **an infected ulcer**
- **Infection** in a diabetic foot is potentially limb-threatening and always requires urgent diagnostic and therapeutic attentions

Causes of amputation



Validation of a Diabetic Wound Classification System

The contribution of depth, **infection**, and ischemia to the risk of amputation

- Patients were more than **11 times** more likely to receive a midfoot or higher level amputation if wound probed to the bone
- Patients with infection and ischemia were **90 times** more likely to receive a midfoot or higher level amputation compared with patients with less advanced wound stages

Armstrong 1998

Diabetic Foot Infection

Invasion and multiplication of microorganisms in tissues accompanied by **tissue destruction** or a **host inflammatory response** usually following skin trauma or ulceration

Lipsky 2001

Louis Pasteur

“ The germ is nothing. It is the terrain in which it is found that is everything.”

Pasteur, L. (1880) De l'attenuation virus du cholera des poules. CR Acad. Sci. 91: 673-680.

Bacterial Bioburden: Spectrum of Clinical Presentations

Contamination



Colonisation (Dow 1999)



Critical colonisation (Kingsley 2001)



Local infection (Cutting + Harding 1994)



Systemic infection



Septicaemia



No problem

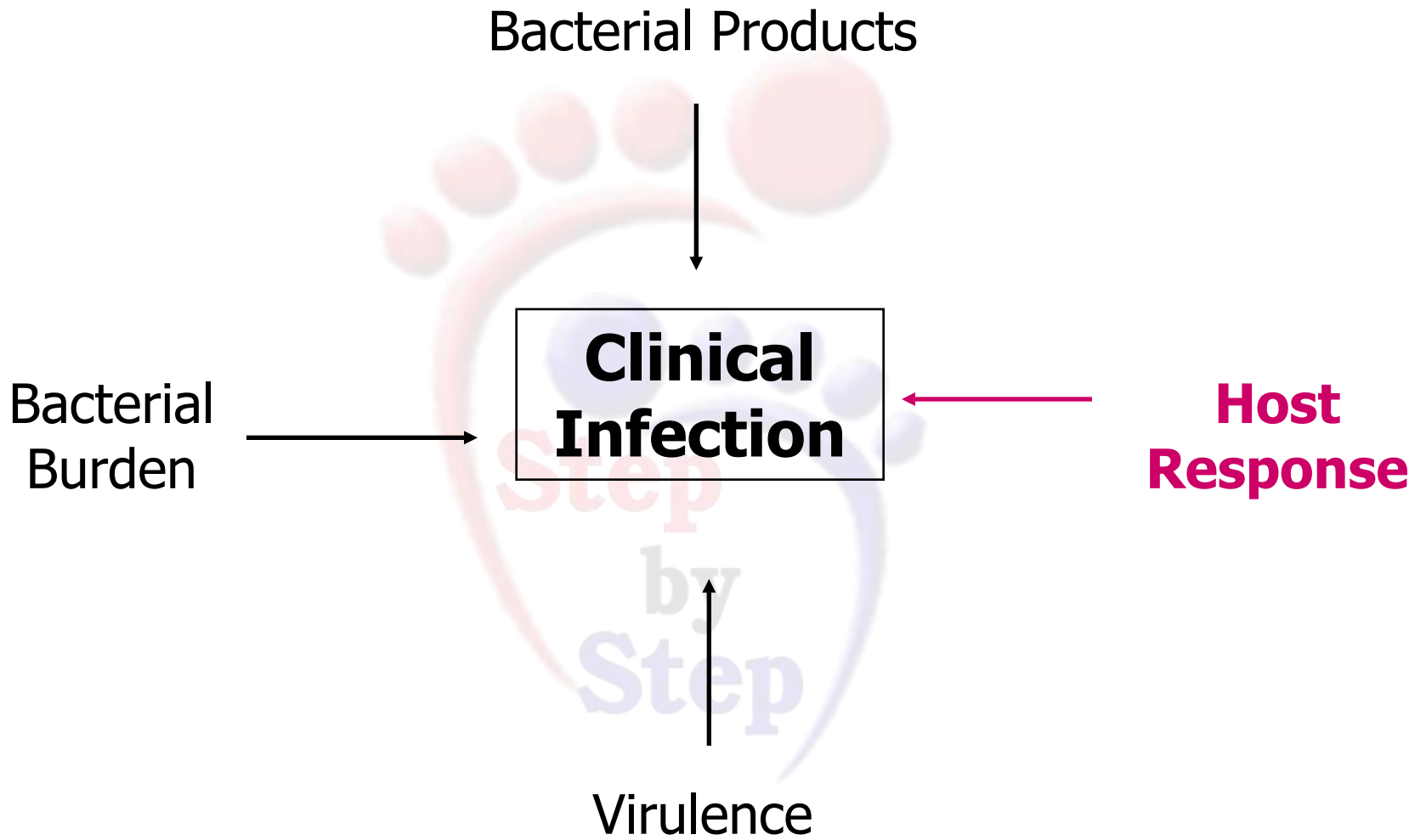


Problem ?



Problem





Unfavourable host conditions

Systemic

- malnutrition
- diabetes mellitus
- renal insufficiency
- immunodeficiency
- jaundice
- steroids
- host age
- cancer

Local

- bioburden
- tissue hypoperfusion
- necrosis
- foreign bodies
- repetitive trauma
- radiation
- cancer
- long wound duration

Unfavourable host conditions

Systemic

- malnutrition
- **diabetes mellitus**
- **renal insufficiency**
- **immunodeficiency**
- jaundice
- steroids
- **host age**
- cancer

Local

- **bioburden**
- **tissue hypoperfusion**
- **necrosis**
- foreign bodies
- **repetitive trauma**
- radiation
- cancer
- **long wound duration**

Which signs are reliably present in diabetic foot infection?

- Signs of an inflammatory reaction (e.g. redness, warmth)
- Systemic signs of infection (e.g. fever)
- Elevated inflammatory markers (e.g. leucocytosis)
- Pain
- None of these



Step
by
Step

Which signs are reliably present in diabetic foot infection?

- Signs of an inflammatory reaction (e.g. redness, warmth)
- Systemic signs of infection (e.g. fever)
- Elevated inflammatory markers (e.g. leucocytosis)
- Pain
- **None of these**

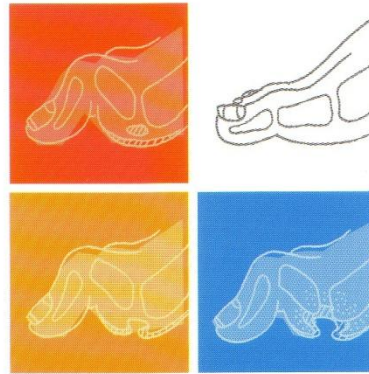


Step
by
Step

INTERACTIVE VERSION

International Consensus on the Diabetic Foot

by the International Working Group on the Diabetic Foot



New Supplements:

- International Consensus on Diagnosing and Treating the Infected Diabetic Foot
- Progress report: Wound Healing and Treatment of people with Diabetic Foot Ulcers
- Progress report: The Diabetic Foot Ulcer Classification System for Research Purposes

International Consensus on Diagnosing and Treating the Infected Diabetic Foot

- **Diagnose wound infections clinically** [not microbiologically] (recognizing that the inflammatory response may be mitigated by diabetic complications), by the presence of purulent secretions or local evidence of inflammation, or occasionally systemic toxicity

International Consensus on Diagnosing and Treating the Infected Diabetic Foot

- Diagnose wound infections clinically [not microbiologically] (recognizing that the inflammatory response may be mitigated by diabetic complications), by the **presence of purulent secretions** or local evidence of inflammation, or occasionally systemic toxicity

International Consensus on Diagnosing and Treating the Infected Diabetic Foot

- Diagnose wound infections clinically [not microbiologically] (recognizing that the inflammatory response may be mitigated by diabetic complications), by the presence of purulent secretions or **local evidence of inflammation**, or occasionally systemic toxicity

International Consensus on Diagnosing and Treating the Infected Diabetic Foot

- Diagnose wound infections clinically [not microbiologically] (recognizing that the inflammatory response may be mitigated by diabetic complications), by the presence of purulent secretions or local evidence of inflammation, or occasionally **systemic toxicity**

International Consensus on Diagnosing and Treating the Infected Diabetic Foot

- **Laboratory tests** (including cultures) **may suggest but do not establish** the presence of infection in diabetic foot wounds

The logo features a stylized footprint in shades of red and blue. Inside the footprint, the words "Step by Step" are written in a sans-serif font. "Step" is in red, "by" is in grey, and "Step" is in blue.

Step
by
Step

IWGDF 2003

Signs that suggest wound infection in diabetic foot ulcers

- **presence of systemic signs of infection** (e.g., fever, chills, leukocytosis, elevated inflammatory markers), or **purulent secretions** (pus)
or
- **two or more local signs or symptoms of inflammation** (e.g., redness, warmth, induration, pain or tenderness)

Signs that suggest wound infection in diabetic foot ulcers

- **presence of systemic signs of infection** (e.g., fever, chills, leukocytosis, elevated inflammatory markers), or **purulent secretions** (pus)
or
- **two or more local signs or symptoms of inflammation** (e.g., redness, warmth, induration, pain or tenderness)

Signs that suggest wound infection in diabetic foot ulcers

- **presence of systemic signs of infection** (e.g., fever, chills, leukocytosis, elevated inflammatory markers), or **purulent secretions** (pus)
or
- **two or more local signs or symptoms of inflammation** (e.g., redness, warmth, induration, pain or tenderness)

Classification of severity of infection

1. Assess the severity of the infection by examining the wound, limb, and the overall status of the patient, to determine the appropriate approach to treatment.
2. Classifying infections by their severity helps determine the site, type and urgency of treatment.



Stop
by
Step

Keys to classifying a diabetic foot infection

- Extent of tissues involved
- Assessing for systemic toxicity
- Adequacy of arterial perfusion



Step
by
Step

IWGDF 2003

GRADE 1 No symptoms or signs of infection

GRADE 2 Infection involving the skin and the subcutaneous tissue only (without involvement of deeper tissues and without systemic signs as described below). At least 2 of the following items are present:

- local swelling or induration,
- erythema > 0.5 - 2 cm around the ulcer
- local tenderness or pain
- local warmth
- purulent discharge (thick, opaque to white or sanguineous secretion)

Other causes of an inflammatory response of the skin should be excluded (e.g. trauma, gout, acute Charcot neuro-osteoarthropathy, fracture, thrombosis, venous stasis)

GRADE 3 Erythema > 2 cm plus one of the items described above (swelling, tenderness, warmth, discharge) or

Infection involving structures deeper than skin and subcutaneous tissues such as abscess, osteomyelitis, septic arthritis, fasciitis.

No systemic inflammatory response signs as described below.

GRADE 4 Any foot infection with the following signs of a systemic inflammatory response syndrome (SIRS). This response is manifested by two or more of the following conditions:

- Temperature > 38 or < 36°Celsius
- Heart rate > 90 beats/min
- Respiratory rate > 20 breaths/min
- PaCO₂ < 32 mmHg
- White blood cell count > 12.000 or < 4.000/cu mm
- 10% immature (band) forms

GRADE 1 No symptoms or signs of infection

GRADE 2 Infection involving the skin and the subcutaneous tissue only (without involvement of deeper tissues and without systemic signs as described below). At least 2 of the following items are present:

- local swelling or induration,
- erythema > 0.5 - 2 cm around the ulcer
- local tenderness or pain
- local warmth
- purulent discharge (thick, opaque to white or sanguineous secretion)

Other causes of an inflammatory response of the skin should be excluded (e.g. trauma, gout, acute Charcot neuro-osteoarthropathy, fracture, thrombosis, venous stasis)

GRADE 3 Erythema > 2 cm plus one of the items described above (swelling, tenderness, warmth, discharge) or

Infection involving structures deeper than skin and subcutaneous tissues such as abscess, osteomyelitis, septic arthritis, fasciitis.

No systemic inflammatory response signs as described below.

GRADE 4 Any foot infection with the following signs of a systemic inflammatory response syndrome (SIRS). This response is manifested by two or more of the following conditions:

- Temperature > 38 or < 36°Celsius
- Heart rate > 90 beats/min
- Respiratory rate > 20 breaths/min
- PaCO₂ < 32 mmHg
- White blood cell count > 12.000 or < 4.000/cu mm
- 10% immature (band) forms



GRADE 1

GRADE 1 No symptoms or signs of infection

GRADE 2 Infection involving the skin and the subcutaneous tissue only (without involvement of deeper tissues and without systemic signs as described below). At least 2 of the following items are present:

- local swelling or induration,
- erythema > 0.5 - 2 cm around the ulcer
- local tenderness or pain
- local warmth
- purulent discharge (thick, opaque to white or sanguineous secretion)

Other causes of an inflammatory response of the skin should be excluded (e.g. trauma, gout, acute Charcot neuro-osteoarthropathy, fracture, thrombosis, venous stasis)

GRADE 3 Erythema > 2 cm plus one of the items described above (swelling, tenderness, warmth, discharge) or

Infection involving structures deeper than skin and subcutaneous tissues such as abscess, osteomyelitis, septic arthritis, fasciitis.

No systemic inflammatory response signs as described below.

GRADE 4 Any foot infection with the following signs of a systemic inflammatory response syndrome (SIRS). This response is manifested by two or more of the following conditions:

- Temperature > 38 or < 36°Celsius
- Heart rate > 90 beats/min
- Respiratory rate > 20 breaths/min
- PaCO₂ < 32 mmHg
- White blood cell count > 12.000 or < 4.000/cu mm
- 10% immature (band) forms



GRADE 2

GRADE 1 No symptoms or signs of infection

GRADE 2 Infection involving the skin and the subcutaneous tissue only (without involvement of deeper tissues and without systemic signs as described below). At least 2 of the following items are present:

- local swelling or induration,
- erythema > 0.5 - 2 cm around the ulcer
- local tenderness or pain
- local warmth
- purulent discharge (thick, opaque to white or sanguineous secretion)

Other causes of an inflammatory response of the skin should be excluded (e.g. trauma, gout, acute Charcot neuro-osteoarthropathy, fracture, thrombosis, venous stasis)

GRADE 3 Erythema > 2 cm plus one of the items described above (swelling, tenderness, warmth, discharge) or

Infection involving structures deeper than skin and subcutaneous tissues such as abscess, osteomyelitis, septic arthritis, fasciitis.

No systemic inflammatory response signs as described below.

GRADE 4 Any foot infection with the following signs of a systemic inflammatory response syndrome (SIRS). This response is manifested by two or more of the following conditions:

- Temperature > 38 or < 36°Celsius
- Heart rate > 90 beats/min
- Respiratory rate > 20 breaths/min
- PaCO₂ < 32 mmHg
- White blood cell count > 12.000 or < 4.000/cu mm
- 10% immature (band) forms



GRADE 3



GRADE 3

GRADE 1 No symptoms or signs of infection

GRADE 2 Infection involving the skin and the subcutaneous tissue only (without involvement of deeper tissues and without systemic signs as described below). At least 2 of the following items are present:

- local swelling or induration,
- erythema > 0.5 - 2 cm around the ulcer
- local tenderness or pain
- local warmth
- purulent discharge (thick, opaque to white or sanguineous secretion)

Other causes of an inflammatory response of the skin should be excluded (e.g. trauma, gout, acute Charcot neuro-osteoarthropathy, fracture, thrombosis, venous stasis)

GRADE 3 Erythema > 2 cm plus one of the items described above (swelling, tenderness, warmth, discharge) or

Infection involving structures deeper than skin and subcutaneous tissues such as abscess, osteomyelitis, septic arthritis, fasciitis.

No systemic inflammatory response signs as described below.

GRADE 4 Any foot infection with the following signs of a systemic inflammatory response syndrome (SIRS). This response is manifested by two or more of the following conditions:

- Temperature > 38 or < 36°Celsius
- Heart rate > 90 beats/min
- Respiratory rate > 20 breaths/min
- PaCO₂ < 32 mmHg
- White blood cell count > 12.000 or < 4.000/cu mm
- 10% immature (band) forms



GRADE 4

Signs indicating deep/severe foot infection

- Systemic toxicity (e.g. fever, leucocytosis)
- Inflammation distant from skin wound



Step
by
Step

IWGDF 2003



Step
by
Step

25.11.2004 10:10



Signs indicating deep/severe foot infection

- Systemic toxicity (e.g. fever, leucocytosis)
- Inflammation distant from skin wound
- Elevated inflammatory markers **despite** appropriate therapy



Step
by
Step

IWGDF 2003

Summary (1)

- Infection is defined as invasion and multiplication of microorganisms in body tissues associated with tissue destruction or a host inflammatory response
- It must be diagnosed clinically, rather than microbiologically



Step
by
Step

Summary (2)

- Neuropathy is the main factor leading to skin breaks, while arterial perfusion largely affects infection outcome
- In almost all superficial infection good clinical response is to be expected
- In deep foot infection an amputation rate of **40-60%** has been described
- In more than **80%** of deep foot infections some kind of surgery is needed to achieve healing and should be considered timely