
بسم الله الرحمن الرحيم

معاونت آموزشی بیمارستان بهار لوبا همکاری گروه تحقیقاتی پای دیابتی پژوه، دانشگاه علوم غدد برگزار می کند

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روش های ارزیابی زخم پای دیابتی
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اصول درمان زخم پای دیابتی
با سخنرانی
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عفونت های زخم پای دیابتی
با سخنرانی
دکتر حدیثه هوسمی، متخصص عفونی

دبیر علمی: دکتر ندا فرجی

امتیاز باز آموزی ویژه: فوق تخصص غدد و عفونی

و پزشکان عمومی متخصصین داخلی و عفونی

شناسه: ۱۷۰۵۰۷– زمان: ۲۷ آبان ۱۴۰۰– ساعت ۹ الی ۱۲

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EMRI

گروه تحقیقاتی پای دیابتی

مرکز تحقیقات دیابت

Type of Diabetic Foot Ulcers

دکتر محمد رضا امینی

پژوهشگاه علوم غدد و متابولیسم

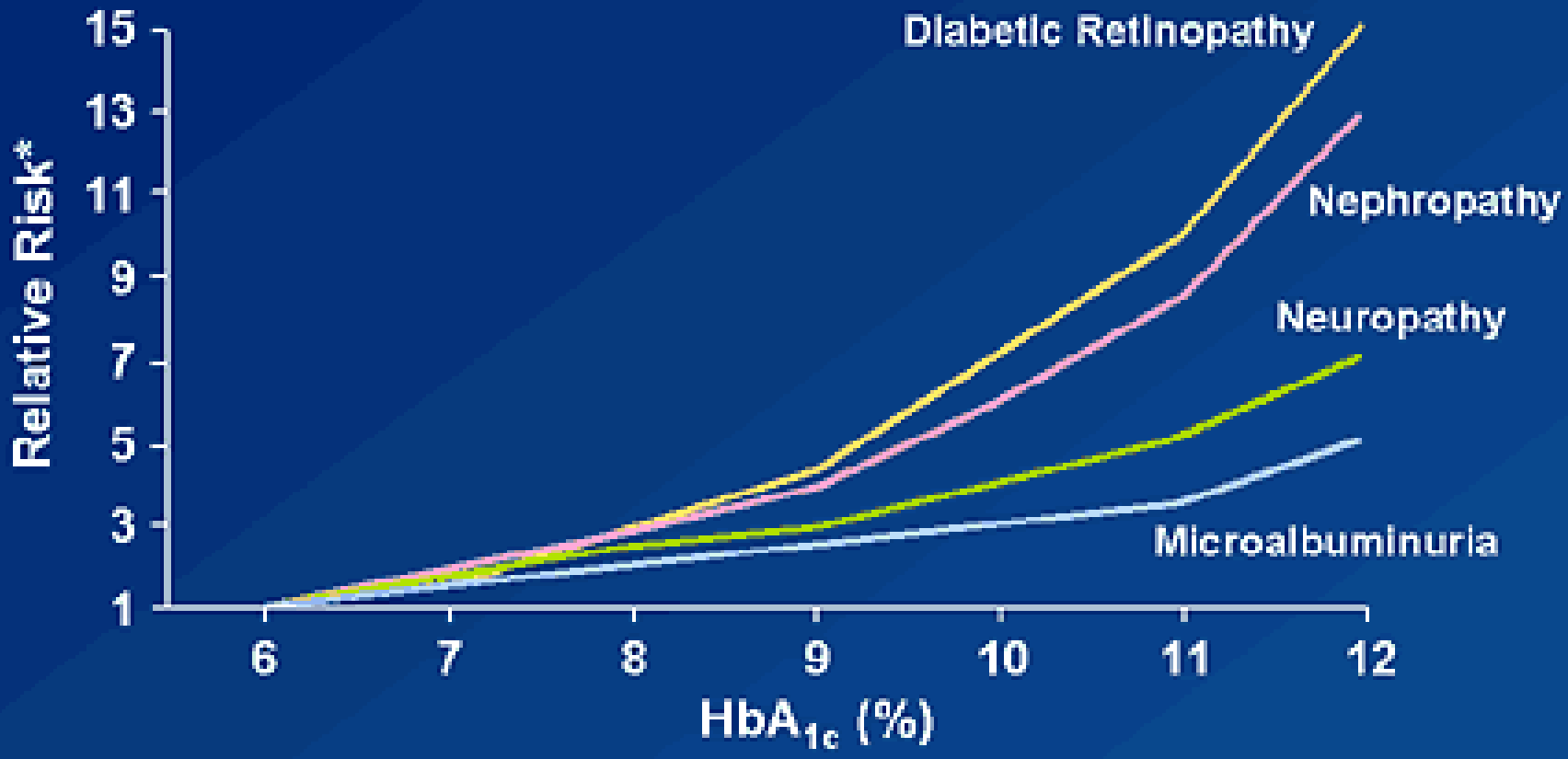
آبان ماه ۱۴۰۰

Epidemiology

Region	٢٠١٧ (million)	٢٠٤٥ (million)	Increase
World	**425**	**629**	**48 %**
Western Pacific	159	183	15 %
Europe	58	67	16 %
North America	46	62	35 %
South & Central America	26	42	62 %
Middle East & North Africa	**39**	**67**	**72 %**
South East Asia	82	151	84 %
Africa	16	41	156 %

8th Edition; IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045

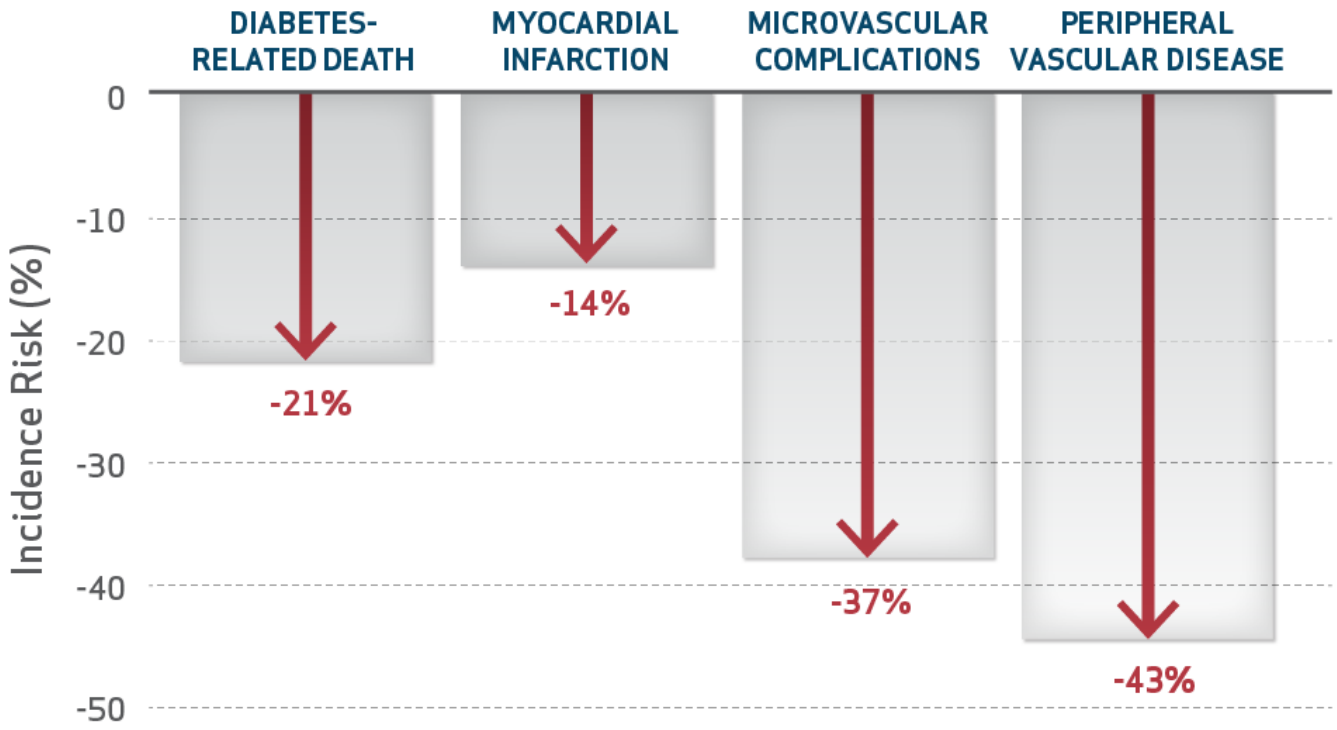
Risk of Progression of Complications by HbA_{1c}: DCCT



* "Stylized" relative risk; relative risk set to 1 for HbA_{1c} of 6%

Skyler. *Endocrinol Metab Clin North Am.* 1996;25:243–254.

RISK REDUCTION BY LOWERING HbA1C BY 1%-POINT

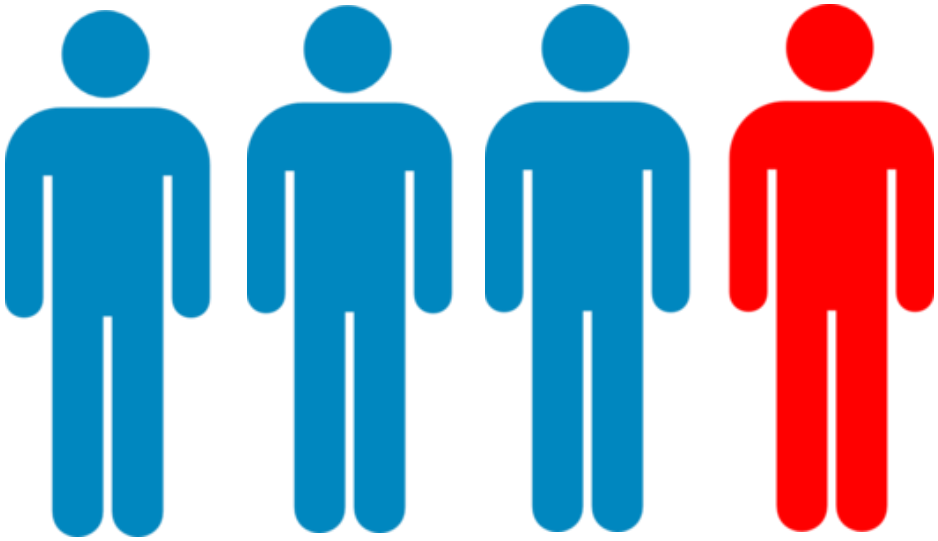


DF Epidemiology

- Prevalence of foot ulcers is **4% - 10%**
- Incidence is **1.0% - 4.1%**
- Lifetime incidence may be as high as **25%**

JAMA. 2005 Jan 12;293(2):217-28.
Preventing foot ulcers in patients with diabetes.
Singh N, Armstrong DG, Lipsky BA.

One in every four patients with diabetes risk developing a DFU in their lifetime



Preventing foot ulcers in patients with diabetes. Singh N, et al. JAMA. 2005 Jan 12;293(2):217-28.

Globally, one leg is lost every

20 seconds

Because of diabetes

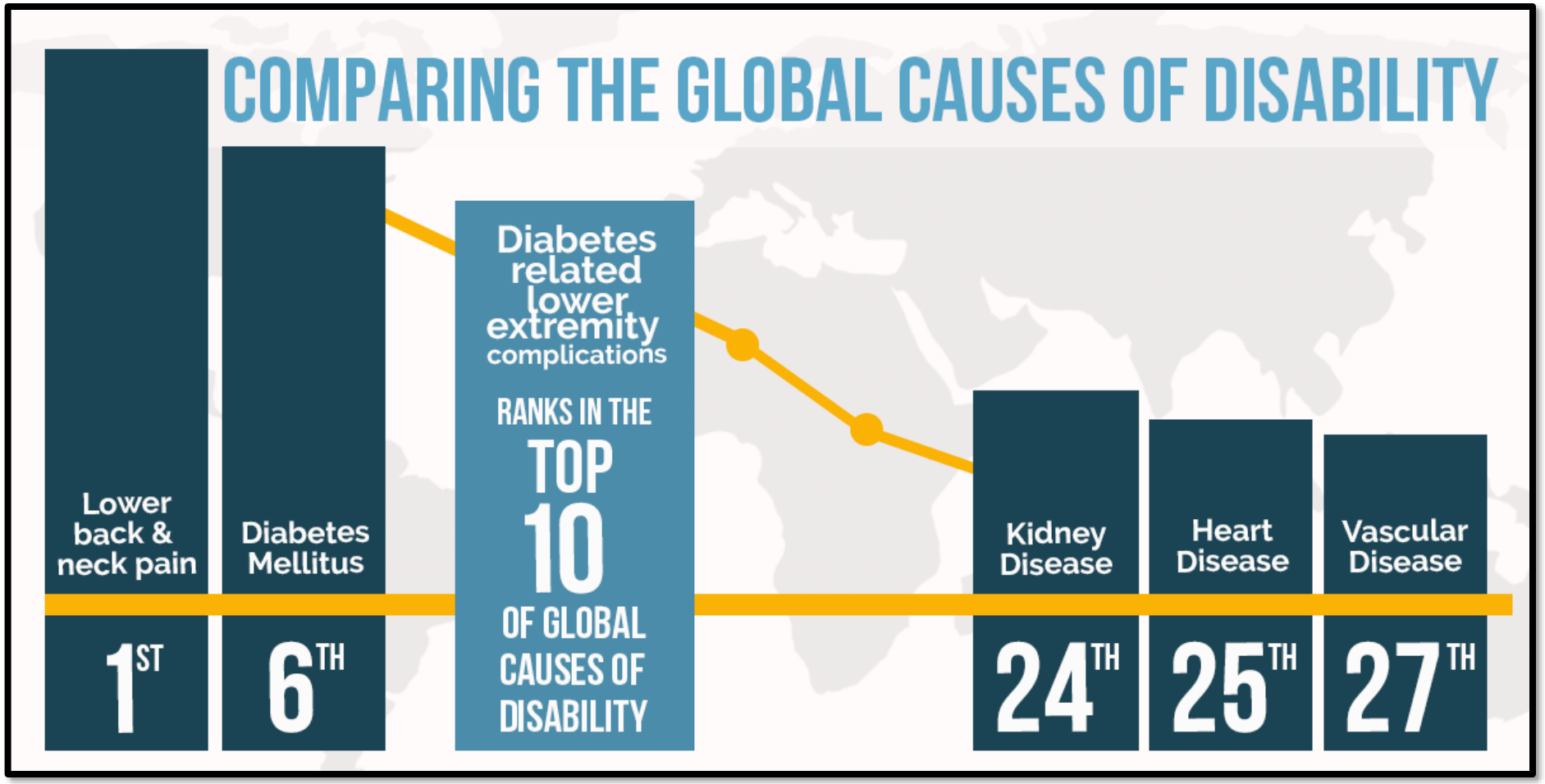
Hinchliffe RJ et al. Effectiveness of revascularization of the ulcerated foot in patients with diabetes and peripheral artery disease: a systematic review. International Working Group on the Diabetic Foot. Diabetes Metab Res Rev. 2016;32 Suppl 1:136-44

Peripheral arterial disease (PAD) is present in **nearly 50%** of patients with diabetes.

Approximately 56% Of DFUs become infected.

About 20% of patients with an infected wound on the foot will undergo a lower extremity amputation.

- Pecoraro RE, Pathways to diabetic limb amputation. Basis for prevention. Diabetes Care. 1990 May;13(5):513-21.
- Prompers L et al. High prevalence of ischaemia, infection and serious comorbidity in patients with diabetic foot disease in Europe. Baseline results from the Eurodiale study. Diabetologia. 2007 Jan;50(1):18-25. Epub 2006 Nov 9
- Wu SC et al. Foot ulcers in the diabetic patient, prevention and treatment Vasc Health Risk Manag. 2007;3(1):65-76. Review

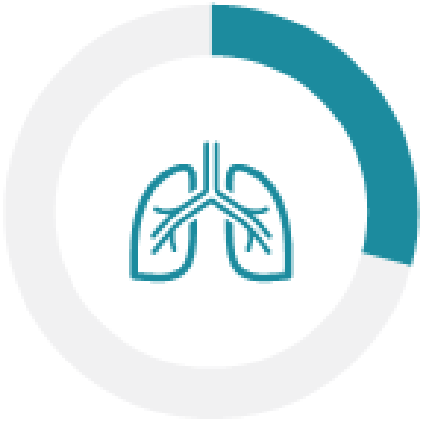


Diabetes-related lower-extremity complications are a leading cause of the global burden of disability, P.A. Lazzarini. et al, 23 May 2018

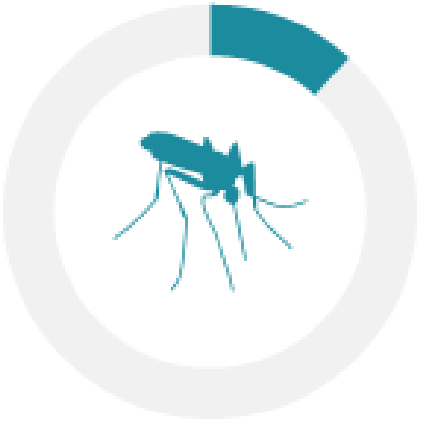
Adults who died from diabetes, HIV/AIDS, tuberculosis, and malaria

5.0 million
from diabetes
2015
IDF

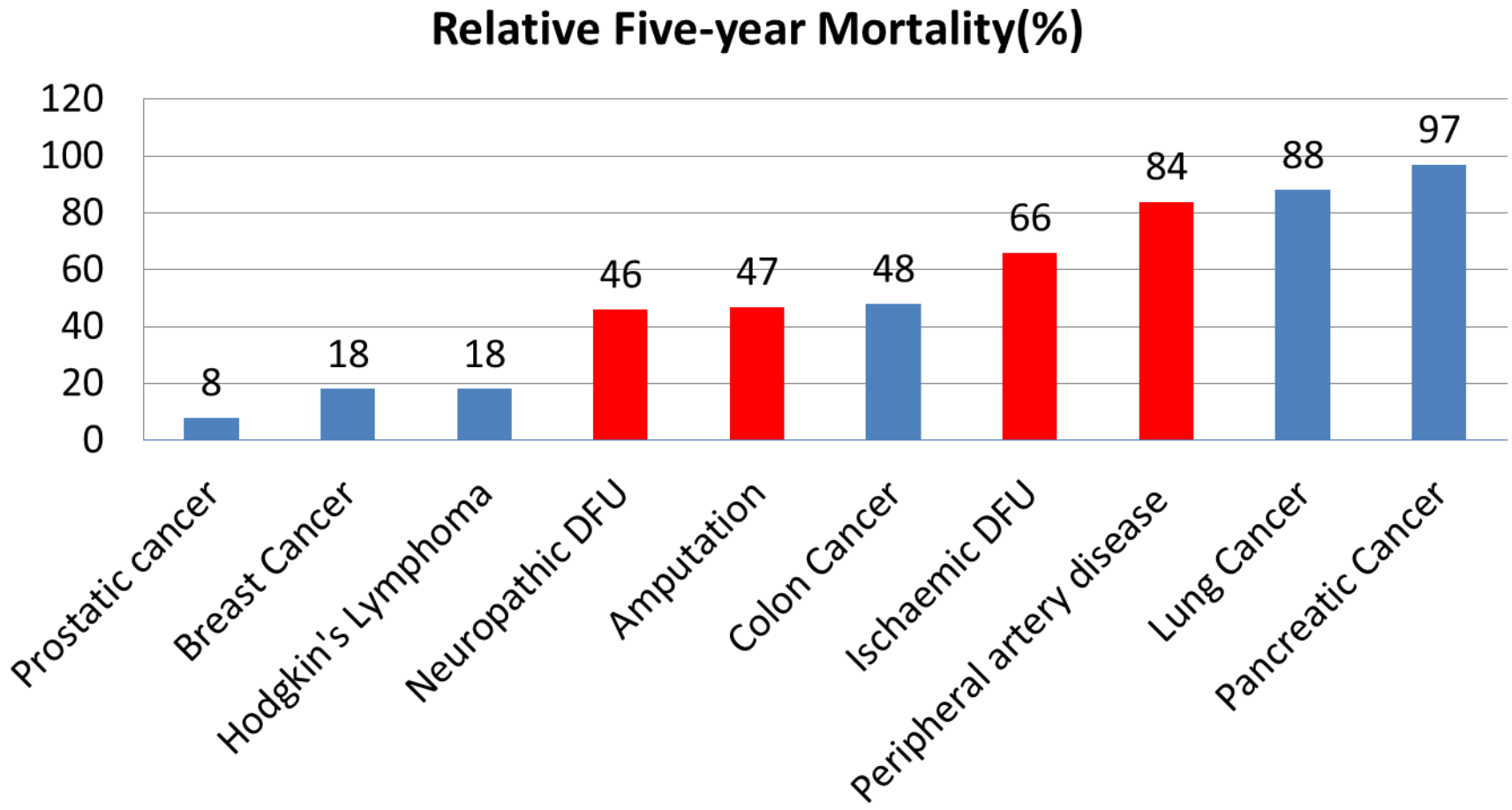
1.5 million
from HIV/AIDS
2013
WHO Global Health Observatory Data Repository 2013



1.5 million
from tuberculosis
2013
WHO Global Health Observatory Data Repository 2013



0.6 million
from malaria
2013
WHO Global Health Observatory Data Repository 2013


Relative Five-year Mortality(%)
120
100
80
60
40
20
0
8
18
18
46
47
48
66
84
88
97
Prostatic cancer
Breast Cancer
Hodgkin's Lymphoma
Neuropathic DFU
Amputation
Colon Cancer
Ischaemic DFU
Peripheral artery disease
Lung Cancer
Pancreatic Cancer

Up to 85%

of amputations can be avoided with

effective care plan

Definition

(based on WHO definition)

Infection, ulceration or destruction of deep tissues

associated with

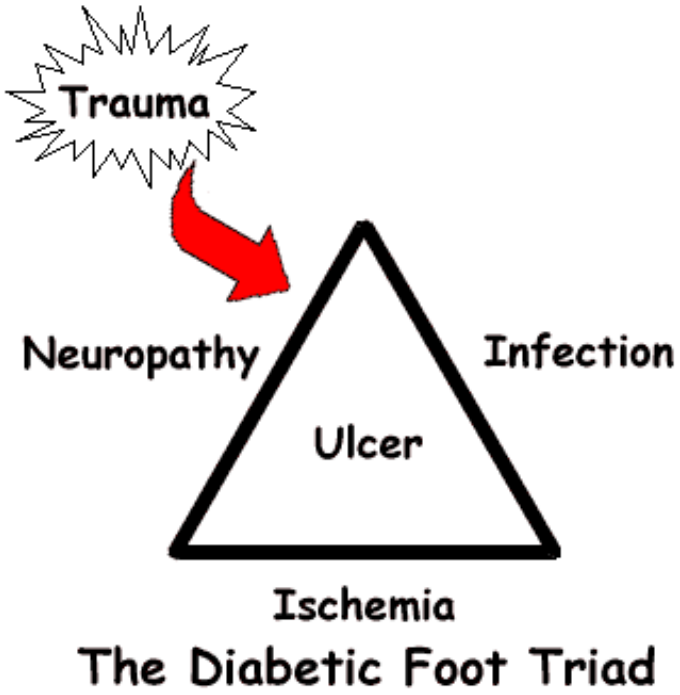
neurological abnormalities &

various degrees of peripheral vascular diseases

in the lower limb.

Etiology

- Three great pathologies come together in the diabetic foot:
  - **Neuropathy**
  - **Ischemia**
  - **Infection**



The Diabetic Foot Triad

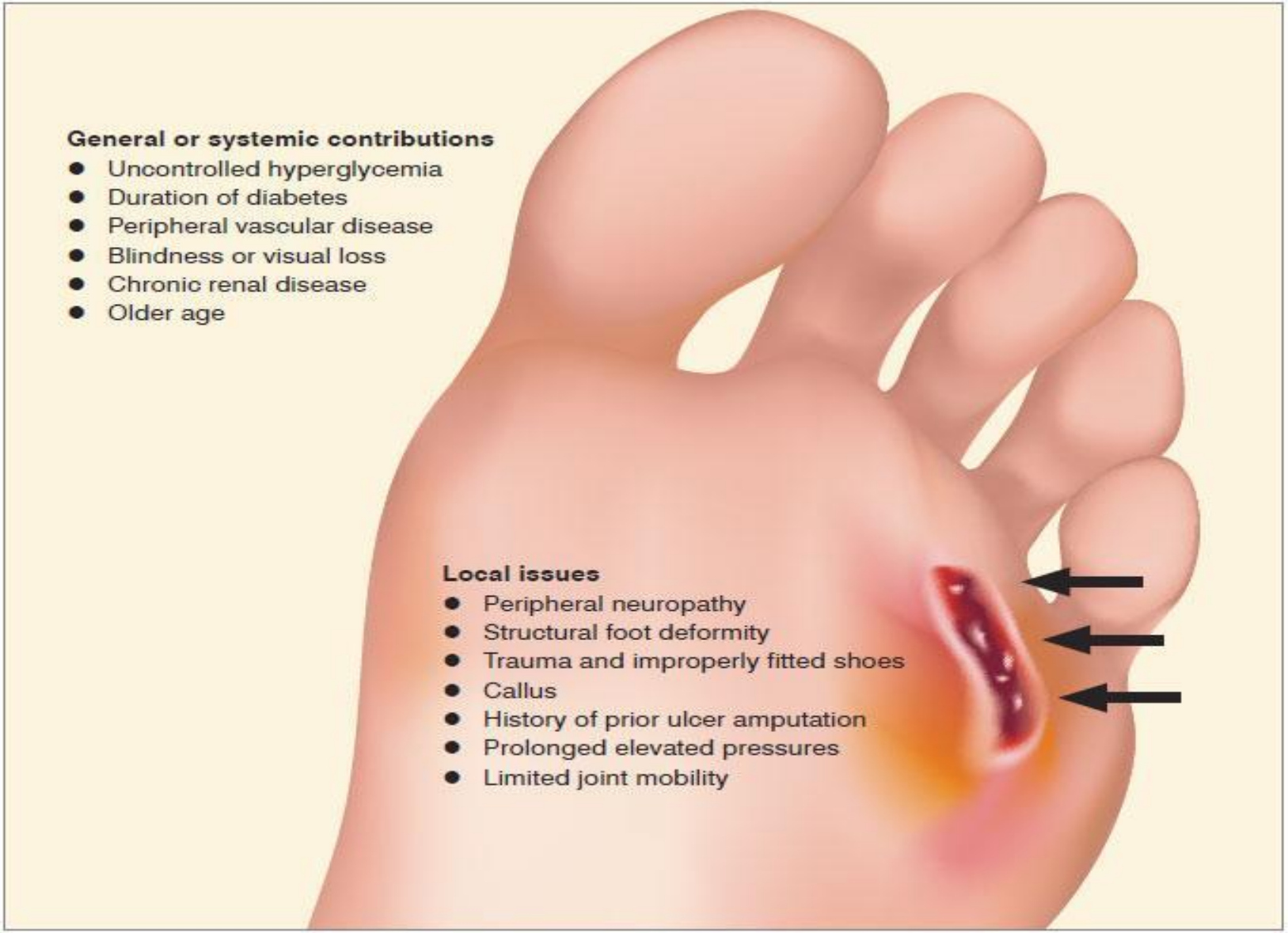
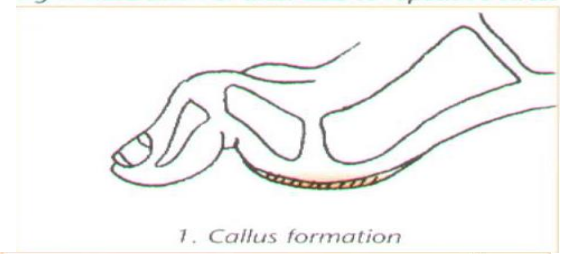


Figure 1: Risk factors for ulceration

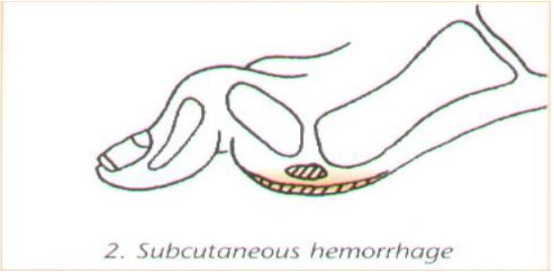
Source: Adapted from The Journal of Foot and Ankle Surgery 2006;45(5 Suppl):S1-664

STAGES OF ULCER DEVELOPMENT

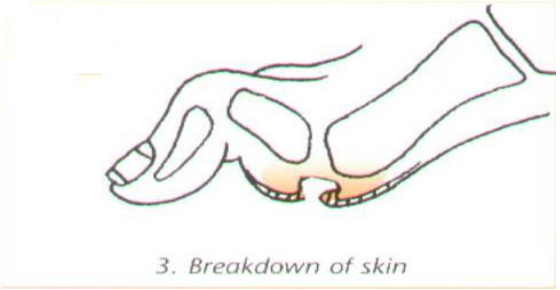
Fig 1. Illustration of ulcer due to repetitive stress



1. Callus formation



2. Subcutaneous hemorrhage



3. Breakdown of skin

4. Deep foot infection with osteomyelitis

Types of Diabetic Foot Ulcers

- **Neuropathic DFU**
- **Ischaemic DFU**
- **Neuroischemic DFU**


Neuropathic


Ischaemic


Neuroischaemic

The neuropathic foot

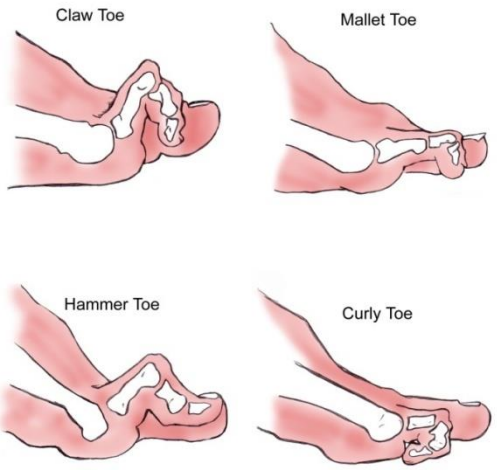
- The neuropathic foot may be further divided into two clinical scenarios:

1. **Foot with neuropathic ulceration**

2. **Charcot foot, which may be secondarily complicated by ulceration**

Motor Neuropathy

- **atrophy or changes in the small muscles** of the foot
- Muscle weakness
- Limb deformity (**claw or hammer toes ,**increase the arch of the foot)
- Abnormal gait patterns



Sensory Neuropathy

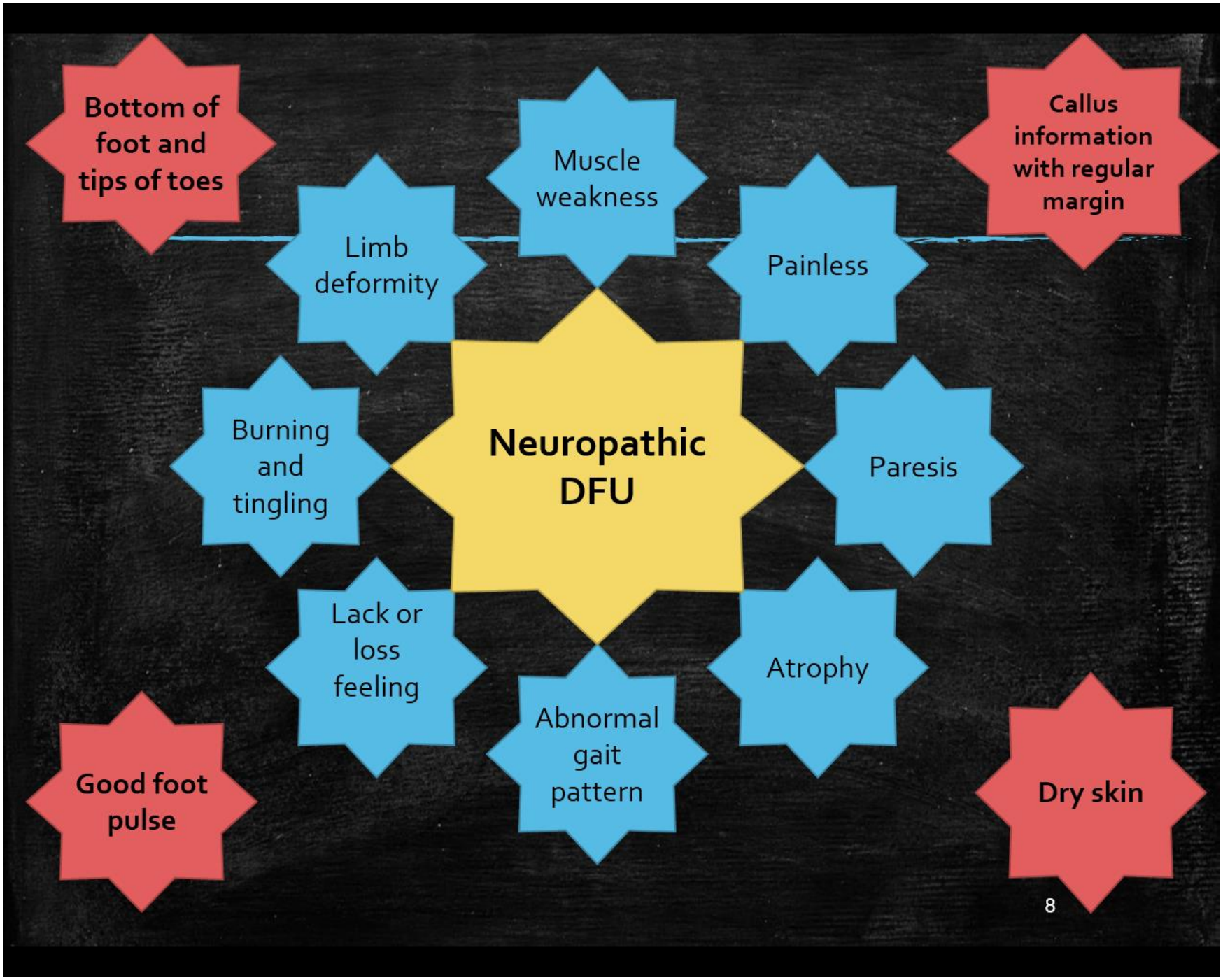
- **Burning and tingling** sensation that becomes more Severe at night
- **Muscle cramps**
- **Lack or loss of f**eeling in the lower extremities

Boulton AJM .Neuropathic diabetic foot ulcers. N Engl J Med 2004; 351:48-55.
Rosenblum BI. Identifying the patient at risk of foot ulceration. Wounds 2000; 12(Suppl B):7B-11B.

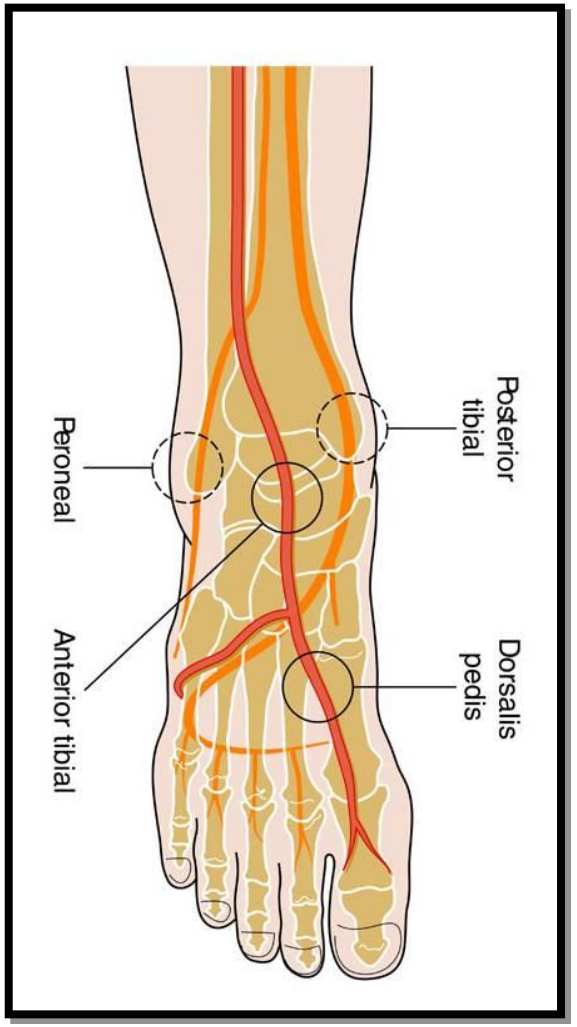
Autonomic neuropathy

- Heart rate abnormality
- Orthostatic hypotension
- Silent MI
- Impotence
  - Retrograde ejaculation

- Distended veins over the dorsum of the foot and ankle
- Pseudo motor dysfunction
  - Denervation of sweat glands


Bottom of foot and tips of toes
Muscle weakness
Callus information with regular margin
Limb deformity
Painless
Burning and tingling
Neuropathic DFU
Paresis
Lack or loss feeling
Atrophy
Abnormal gait pattern
Good foot pulse
Dry skin

Ischemic DFU



Ischaemic Foot

- The ischaemic foot may be divided into four clinical scenarios:
  1. **Neuroischaemic foot**
  2. **Critically ischaemic foot**
  3. **Acutely ischaemic foot**
  4. **Renal ischemic foot**

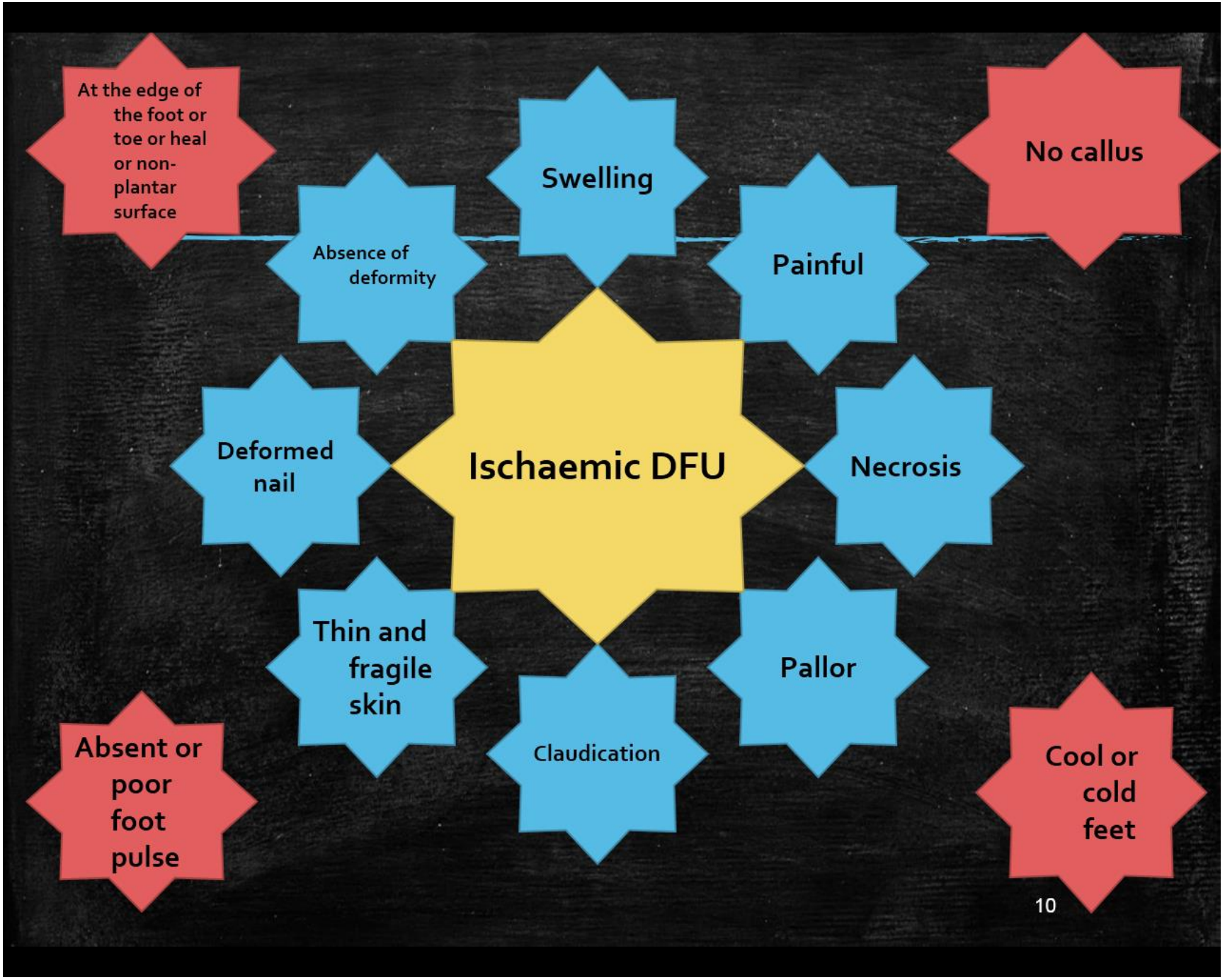
Critically Ischaemic Foot

- This presents as a **pink**, often **painful** foot with pallor on elevating the foot and rubor on dependency.

- The colour of the critically ischaemic foot can be a deceptively healthy pink or red, caused by dilatation of capillaries in an attempt to improve perfusion

Acutely Ischaemic Foot

- This presents initially with sudden **pallor** and the foot becomes **mottled**


At the edge of the foot or toe or heal or non-plantar surface
Swelling
No callus
Absence of deformity
Painful
Deformed nail
Ischaemic DFU
Necrosis
Thin and fragile skin
Pallor
Claudication
Absent or poor foot pulse
Cool or cold feet

Typical features of DFUs according to etiology

Feature	Neuropathic	Ischaemic	Neuroischaemic
Sensation	Sensory loss	Painful	Degree of sensory loss
Callus/necrosis	Callus present and often thick	Necrosis common	Minimal callus Prone to necrosis
Wound bed	Pink and granulating, surrounded by callus	Pale and sloughy with poor granulation	Poor granulation
Foot temperature and pulses	Warm with bounding pulses	Cool with absent pulses	Cool with absent pulses
Other	Dry skin and fissuring	Delayed healing	High risk of infection
Typical location	Weight-bearing areas of the foot, such as metatarsal heads, the heel and over the dorsum of clawed toes	Tips of toes, nail edges and between the toes and lateral borders of the foot	Margins of the foot and toes

Armstrong DG, Cohen K, Courric S, et al. Diabetic foot ulcers and vascular insufficiency. *J Diabetes Sci Technol 2011; 5(6): 1591-95.*

Classification of DFU

- Classification of ulcerations can facilitate a logical to treatment and aid in the **prediction of outcome.**

- Several wound classification systems have been created, based on parameters such as:
  - Extent of infection
  - Neuropathy
  - Ischemia
  - Depth or extent of tissue loss
  - Location

Wagner-Meggitt
Diabetic Wound Classification System

Grade	Lesion
0	No open lesion, may have deformity or cellulites
1	Superficial diabetic ulcer (partial or full thickness)
2	Ulcer extension to ligament, tendon, joint capsule, or deep fascia without abscess or osteomyelitis
3	Deep ulcer with abscess, osteomyelitis , or joint sepsis
4	Gangrene localized to option of forefoot or heel
5	Extensive gangrenous involvement of the entire foot

Wagner- G 0

No open lesion, may have deformity or cellulites

Wagner- G 1

Superficial diabetic ulcer (partial or full thickness)

Wagner- G 2

Ulcer extension to ligament, tendon, joint capsule, or deep fascia without abscess or osteomyelitis

Wagner- G 3

Deep ulcer with abscess, osteomyelitis , or joint sepsis

Wagner- G 4

Gangrene localized to option of forefoot or heel

Wagner- G 5

Extensive gangrenous involvement of the entire foot

University Of Texas
Diabetic Wound Classification System

Stages	Description
Stage A	No infection or ischemia
Stage B	Infection present
Stage C	Ischemia present
Stage D	Infection and ischemia present

Grading	Description
Grade 0	Epithelialized wound
Grade 1	Superficial wound
Grade 2	Wound penetrates to tendon or capsules
Grade 3	Wound penetrates to bone or joint

University Of Texas Classification System

	0	1	2	3
A	Pre or postulcerative lesions (Epithelialized)	Superficial, not involving capsule, tendon or bone	PENETRATES TO TENDON OR CAPSULE	PENETRATES TO BONE
B	INFECTION	INFECTION	INFECTION	INFECTION
C	ISCHEMIA	ISCHEMIA	ISCHEMIA	ISCHEMIA
D	INFECTION AND ISCHEMIA	INFECTION AND ISCHEMIA	INFECTION AND ISCHEMIA	INFECTION AND ISCHEMIA

King’s Classification

King’s Classification

Stages	Lesion
Stage1	Normal foot
Stage2	High risk
Stage3	Ulcerated foot
Stage4	Infected foot
Stage5	Necrotic foot

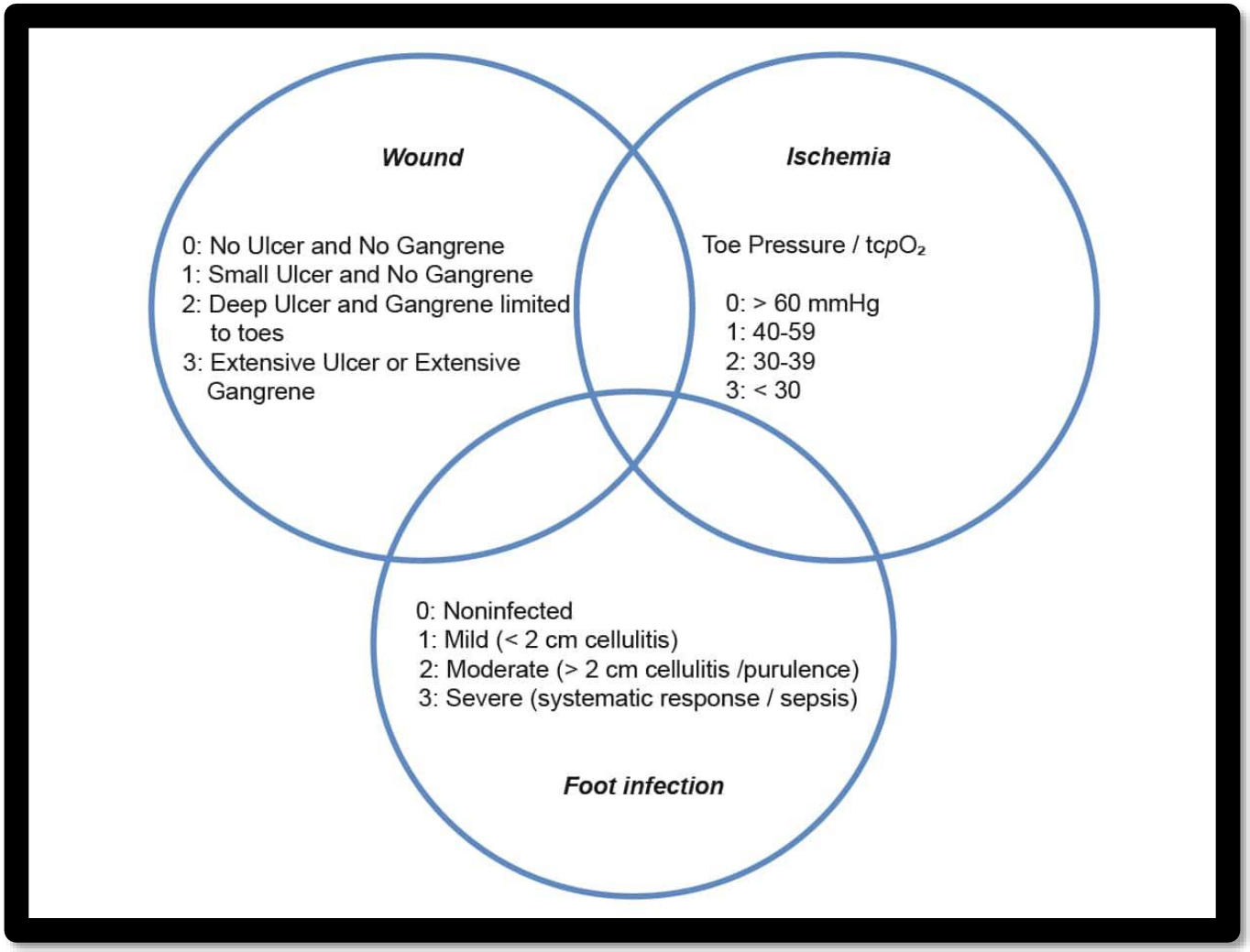
PEDIS Classification

Grade	Perfusion	Extent	Depth	Infection	Sensation	Score
1	No PAD	Skin Intact	Skin Intact	None	No Loss	0
2	PAD, No CLI	<1cm²	Superficial	Surface	Loss	1
3	CLI	1-3 cm²	Fascia, Tendon, Muscle	Abscess, Fascitis, Septic Arthritis		2
4		>3 cm²	Bone or Joint	SIRS		3

Classifications of Diabetic Foot Infection

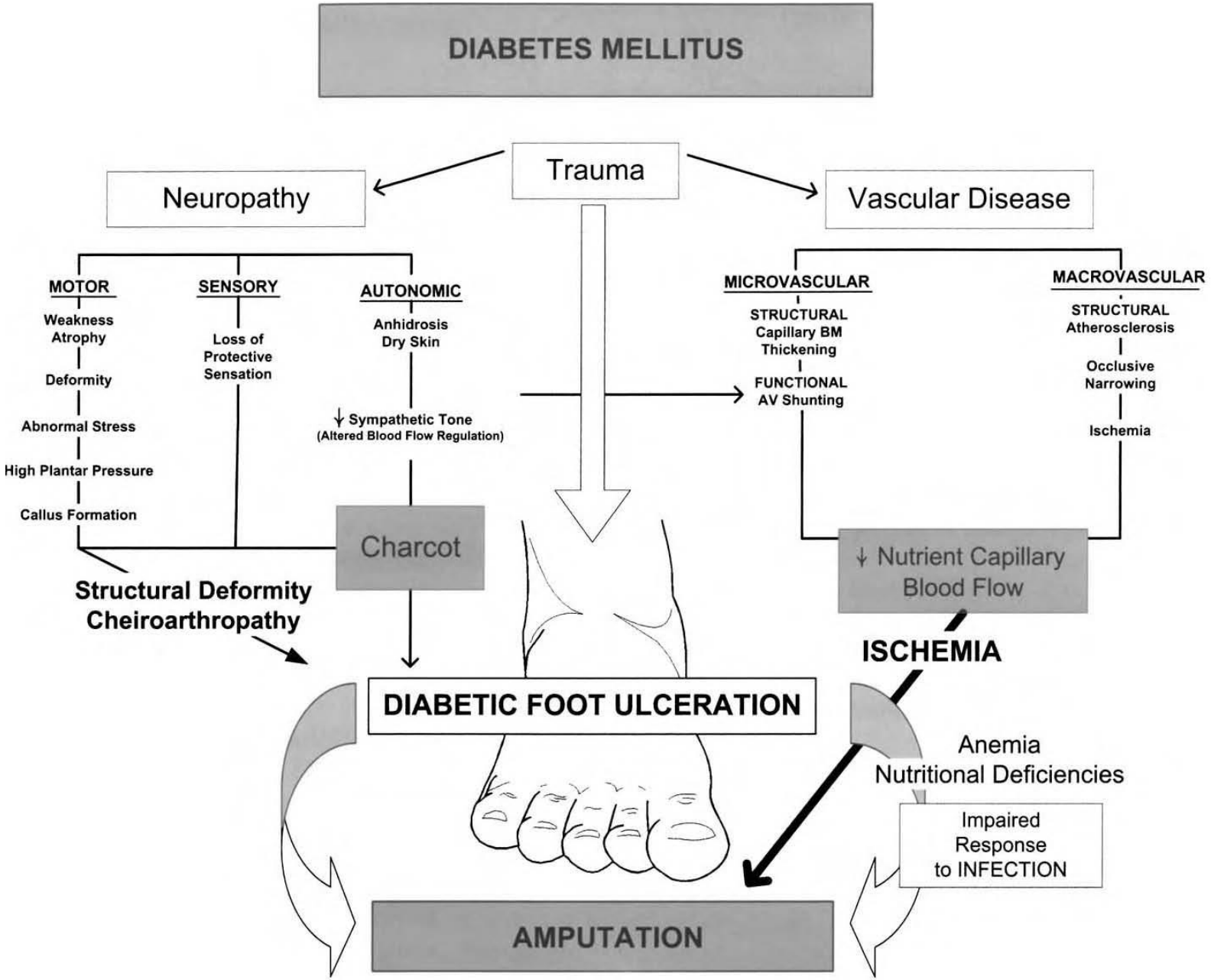
Clinical Manifestation of Infection	PEDIS Grade	IDSA Infection Severity
No symptom or signs of infection	**1**	**Uninfected**
Local infection involving only the skin and subcutaneous tissue. If erythema, must be > 0.5 cm to ≤ 2 cm around the ulcer. Exclude other causes of an inflammatory response of the skin: Trauma, Gout, Acute Charcot, Fracture, Thrombosis, Venous stasis	**2**	**Mild**
Local infection with erythema > 2 cm, or involving structures deeper than skin and subcutaneous tissues (abscess, osteomyelitis, septic arthritis, fasciitis) and No systemic inflammatory response signs(SIRS)	**3**	**Moderate**
Local infection with signs of SIRS, as manifested by ≥ 2 of following : -Temperature > 38 °c or < 36 °c -Heart rate > 90 beats/min -Respiratory rate > 20 breaths/minor $Paco_2$ < 32 mmHg -WBC count > 12000 or < 4000 cell/µl or ≥ 10% immature (band) forms	**4**	**Severe**

WIfI Classification



SINBAD Classification

Category	Definition	SINBAD score
Site	•Forefoot •Midfoot and hindfoot	0 1
Ischemia	•Pedal blood flow intact, at least one pulse palpable •Clinical evidence of reduced pedal blood flow	0 1
Neuropathy	•Protective sensation intact •Protective sensation lost	0 1
Bacterial Infection	•None •Present	0 1
Area	•Ulcer<1 cm^2 •Ulcer>=1 cm^2	0 1
Depth	•Ulcer confined to skin and subcutaneous tissue •Ulcer reaching muscle, tendon or deeper	0 1


DIABETES MELLITUS
Trauma
Neuropathy
Vascular Disease
MOTOR
Weakness
Atrophy
Deformity
Abnormal Stress
High Plantar Pressure
Callus Formation
SENSORY
Loss of
Protective
Sensation
AUTONOMIC
Anhidrosis
Dry Skin
↓ Sympathetic Tone
(Altered Blood Flow Regulation)
MICROVASCULAR
STRUCTURAL
Capillary BM
Thickening
FUNCTIONAL
AV Shunting
MACROVASCULAR
STRUCTURAL
Atherosclerosis
Occlusive
Narrowing
Ischemia
Charcot
Structural Deformity
Cheiroarthropathy
↓ Nutrient Capillary
Blood Flow
ISCHEMIA
DIABETIC FOOT ULCERATION
Anemia
Nutritional Deficiencies
Impaired
Response
to INFECTION
AMPUTATION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مرکز تحقیقات دیابت
پژوهشگاه علوم غدد و متابولیسم
دانشگاه علوم پزشکی تهران
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جنب بیمارستان دکتر شریعتی،پلاک۱۰ کد پستی: ۱۳۱۳۷-۱۴۱۱۷
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