



International
Diabetes
Federation

The diabetic foot a focus on ischemia and infection

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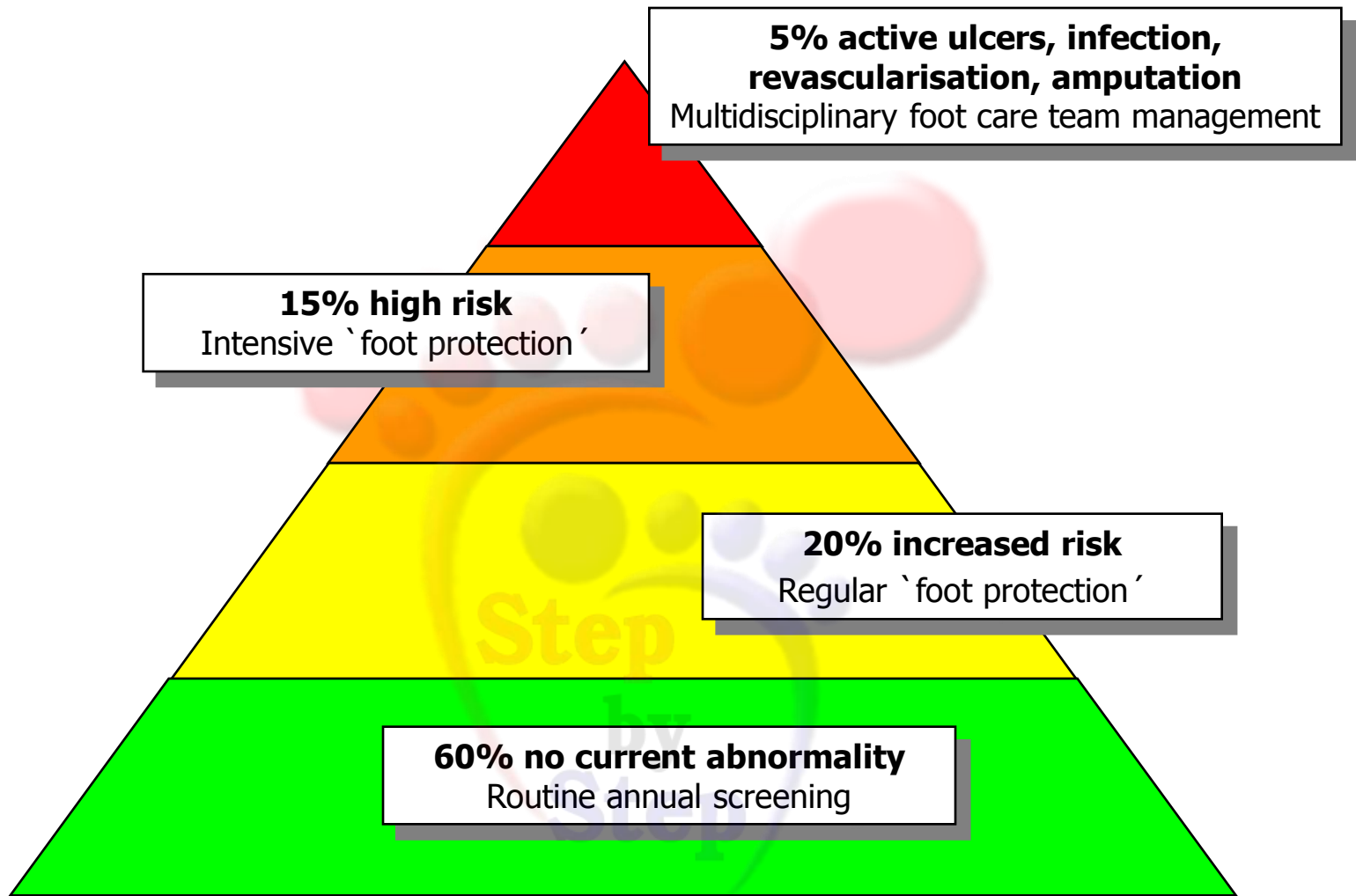
Epidemiology of Diabetic Foot Ulcers

More than **40%** of all people with diabetes have risk factors for foot complications and **15% to 20%** of them will develop a foot ulcer during their lifetime



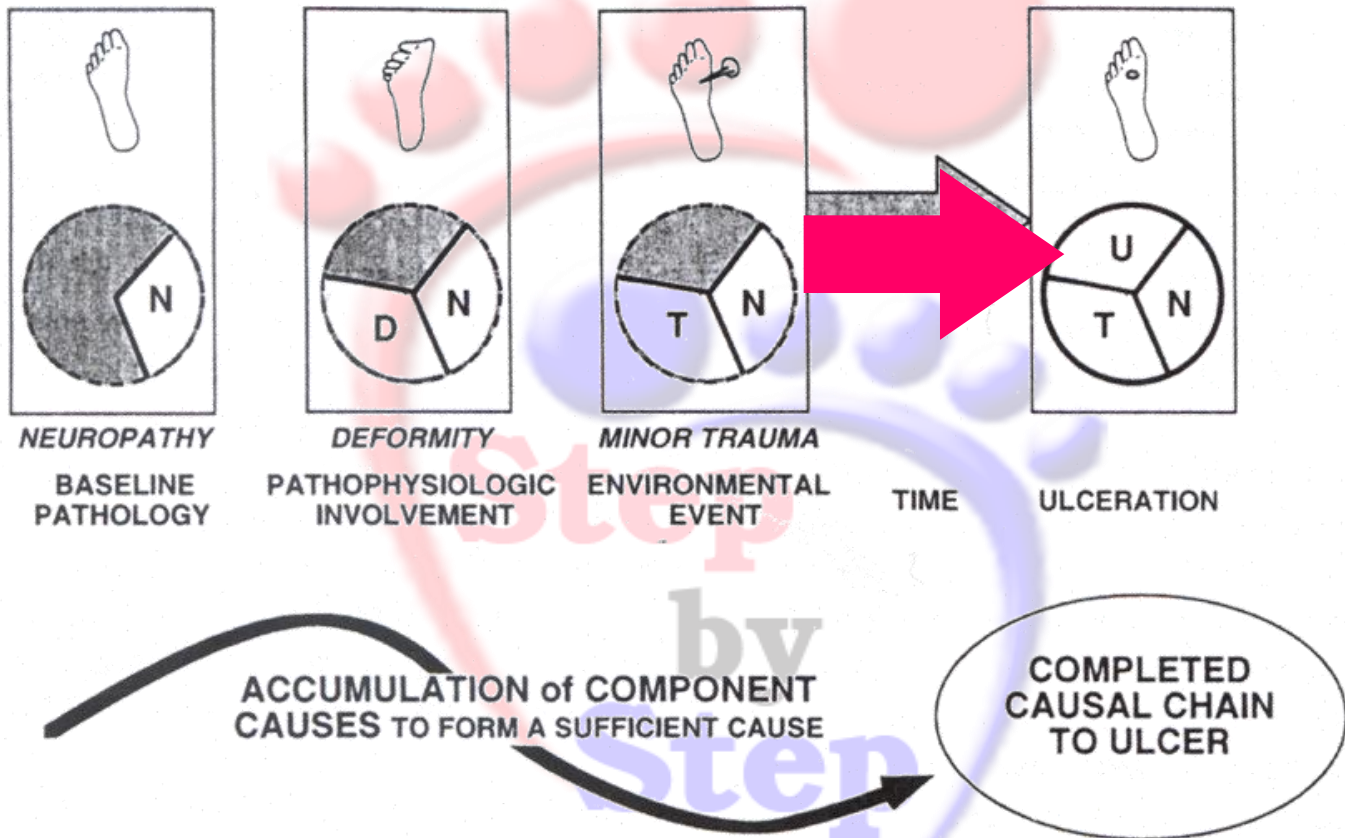
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Palumbo, 1984



Robert J. Young in: Boulton, Cavanagh, Rayman (Eds.)
The Foot in Diabetes, 4th Edition, 2006

Causal Pathways to Diabetic Foot Ulcers



Causal pathways for incident lower-extremity ulcers in patients with diabetes

A critical triad (neuropathy, minor foot trauma, foot deformity) is present in **> 60%** of patient's causal pathways to foot ulcers

Only **1%** overall frequency of infection as a component cause for foot ulcers

Reiber 1999

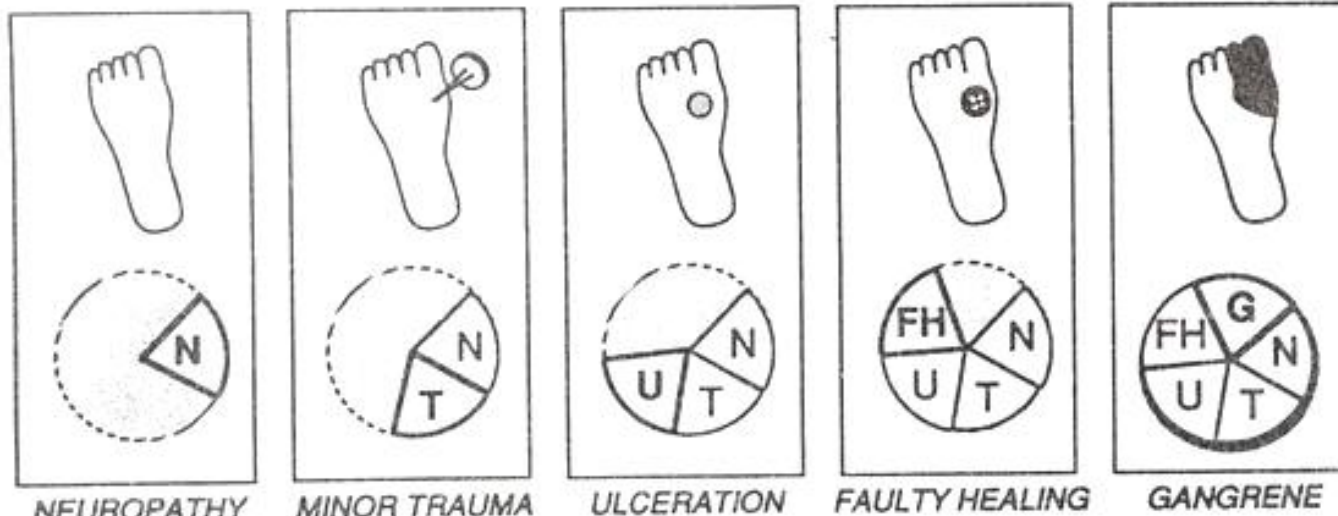
Causal pathways for incident lower-extremity ulcers and amputation in patients with diabetes

A critical triad (neuropathy, minor foot trauma, foot deformity) is present in > 60% of patient's causal pathways to foot ulcers

Only 1% overall frequency of infection as a component cause for foot ulcers contrasted with a **59%** frequency in the study of pathways to lower-limb amputation

Reiber 1999, Pecoraro 1990

Pathways to Diabetic Limb Amputation



BASELINE
PATHOLOGY

+

ENVIRON-
MENTAL
EVENT

+

SKIN
LESION

+

INTERCURRENT
PATHO-
PHYSIOLOGY

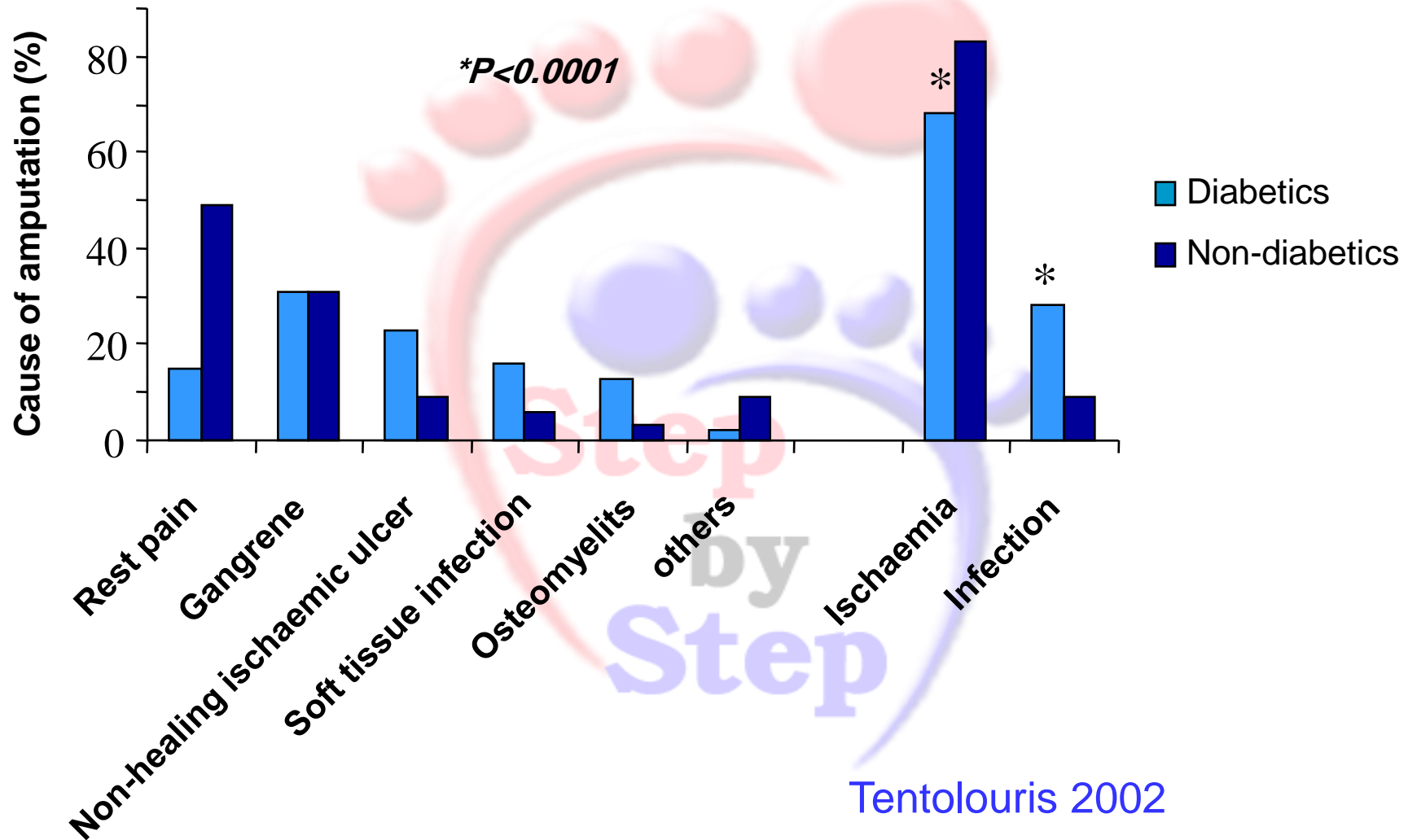
+

INTERCURRENT
PATHO-
PHYSIOLOGY

ACCUMULATION of COMPONENT
CAUSES TO FORM A SUFFICIENT CAUSE

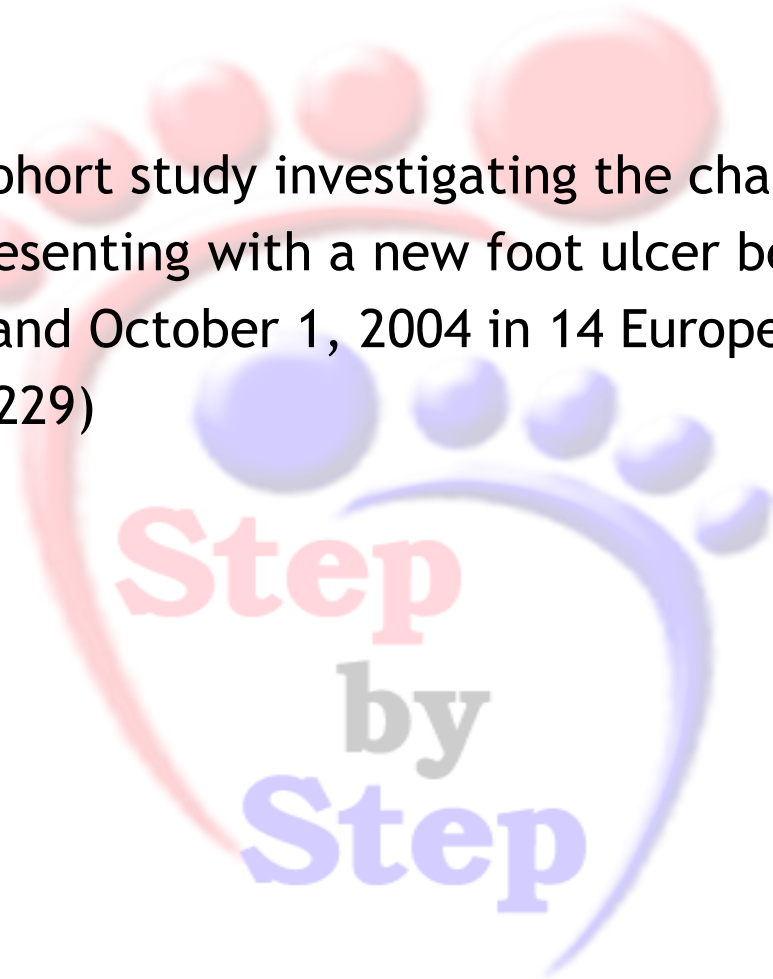
COMPLETED
CAUSAL CHAIN
TO AMPUTATION

Causes of amputation



High prevalence of ischaemia, infection and serious comorbidity in patients with diabetic foot disease in Europe. Baseline results from the Eurodiale study

- Large prospective cohort study investigating the characteristics of diabetic patients presenting with a new foot ulcer between September 1, 2003 and October 1, 2004 in 14 European hospitals in ten countries (n= 1,229)



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- Peripheral arterial disease was diagnosed in **49%** of Patients with Diabetic Foot Disease (Stage C 18%, Stage D 31%)

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Assessing ulcer severity in the the Diabetic Foot

Wagner-Grade →	0	1	2	3	4	5
Armstrong - Stage ↓						
A	Pre- or postulcerative Foot	Superficial wound	Wound with bone and tendon exposure	Wound with bone and tendon involvement	Gangrene of parts of the foot	Gangrene of the entire foot
B	with Infection	with Infection	with Infection	with Infection	with Infection	with Infection
C	with Ischemia	with Ischemia	with Ischemia	with Ischemia	with Ischemia	with Ischemia
D	with Infection and Ischemia	with Infection and Ischemia	with Infection and Ischemia	with Infection and Ischemia	with Infection and Ischemia	with Infection and Ischemia

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German Program for National Disease Management Guidelines: Management and interfaces

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D	with Infection and Ischemia	with Infection and Ischemia	with Infection and Ischemia	with Infection and Ischemia	with Infection and Ischemia	with Infection and Ischemia



= Primary Care



= Specialized out-patient care



= Specialized hospital care

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Prediction of outcome in individuals with diabetic foot ulcers: focus on the differences between individuals with and without peripheral arterial disease. The EURODIALE Study.

- RESULTS: After 1 year of follow-up, 23% of the patients were unhealed
- Independent baseline predictors of non-healing:
 - older age
 - male sex
 - heart failure
 - the inability to stand or walk without help,
 - end-stage renal disease
 - larger ulcer size
 - peripheral neuropathy
 - peripheral arterial disease (PAD)

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Prediction of outcome in individuals with diabetic foot ulcers: focus on the differences between individuals with and without peripheral arterial disease. The EURODIALE Study.

- When analyses were performed according to PAD status, **infection emerged as a specific predictor of non-healing in PAD patients only**

Prompers L et al., Diabetologia 2008

Fontaine Classification

- I Asymptomatic**
- II Intermittent Claudication**
 - II a Claudication walking > 200m**
 - II b Claudication walking < 200m**
- III Rest/nocturnal pain**
- IV Necrosis/gangrene**



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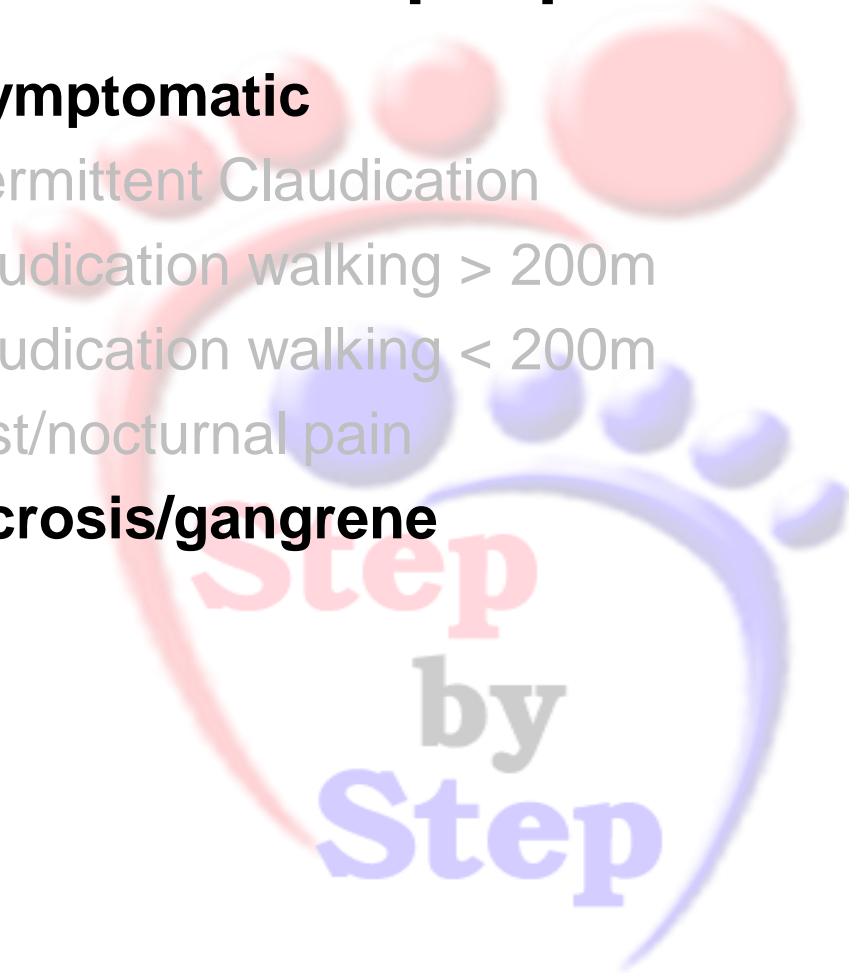
AMERICAN DIABETES ASSOCIATION CONSENSUS STATEMENT

Peripheral Arterial Disease in People With Diabetes

“The true prevalence of PAD in people **with diabetes** has been difficult to determine, **as most patients are asymptomatic**, many do not report their symptoms, screening modalities have not been uniformly agreed upon, and **pain perception may be blunted by the presence of peripheral neuropathy**“.

Fontaine Classification in people with diabetes (?)

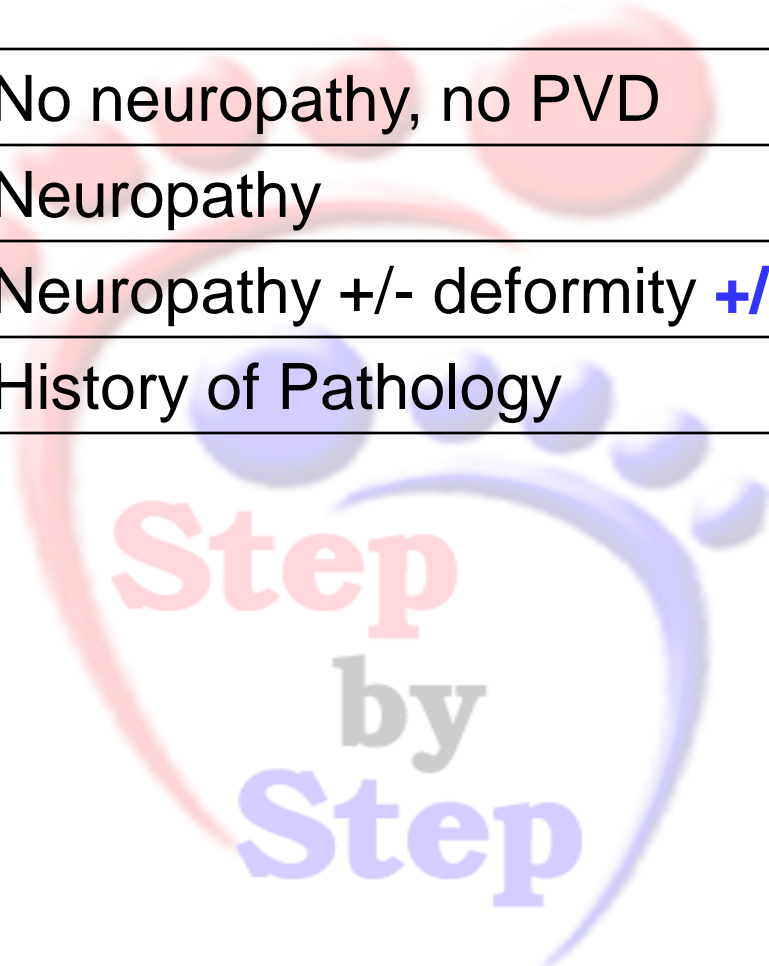
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Foot Risk Classification, 1.0

Risk Group 0	No neuropathy, no PVD
Risk Group 1	Neuropathy
Risk Group 2	Neuropathy +/- deformity +/- PVD
Risk Group 3	History of Pathology

Peters et al., 2001



Diabetic Foot Risk Classification Predicts Outcomes

N=1,666	Ulcer	Amputation	Hospitalization
1.No disease	2.0%	0	0
2.PN	4.5%	0	1.0%
3.PN + deformity	3.0%	0.7%	1.8%
5.Ulcer history	31.7%	2.2%	8.2%
6. Amp history	32.2%	21.0%	50%

Lavery et al., 2008

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4.PVD	13.8%	3.7%	15.9%
5.Ulcer history	31.7%	2.2%	8.2%
6. Amp history	32.2%	21.0%	50%

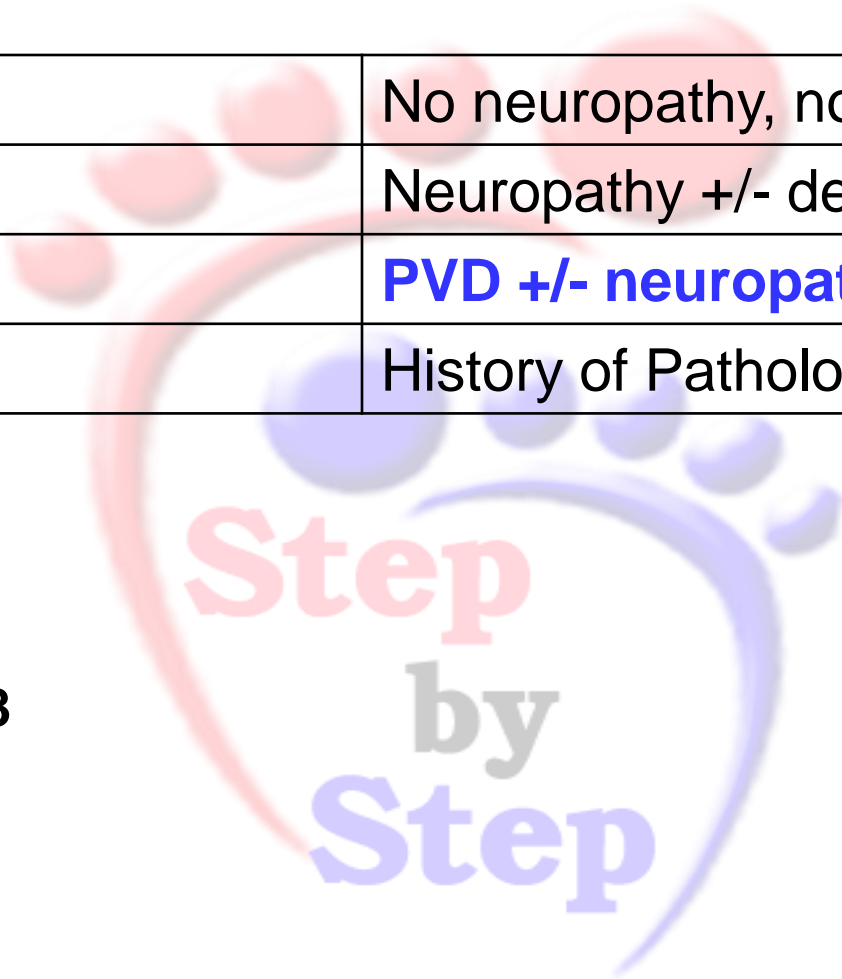
Lavery et al., 2008

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Foot Risk Classification, 2.0

Risk Group 0	No neuropathy, no PVD
Risk Group 1	Neuropathy +/- deformity
Risk Group 2	PVD +/- neuropathy
Risk Group 3	History of Pathology

Lavery et al., 2008



The Diabetic Foot

Data from India, Tanzania and Germany

	India	Tanzania	Germany
Patient age (years)	56.4*	51.4	70.5**
Neuropathy (%)	82	82	78
PAOD (%)	13	12	48**

* p=0.004

**p<0.001

Morbach et al., 2004

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Healing w/o amputation (%)	77	73	76
Major-amputation (%)	6.1	11.3	7.8
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Morbach et al., 2004

All-Cause Mortality After Diabetes - Related Amputation in Barbados: A Prospective Case - Control Study

		Barbados	
Death due to septic condition (%)		27	
Death due to cardiovascular event (%)		35	

Hambleton et al., 2009

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All-Cause Mortality After Diabetes - Related Amputation in Barbados: A Prospective Case - Control Study; Response to Hambleton et al.

	Tanzania	Barbados	Germany
Death due to septic condition (%)	52	27	3
Death due to cardiovascular event (%)	19	35	60

Hambleton et al., 2009, Morbach et al., 2009

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Positions in Human Development Index 2009

	position	HDI
Germany	22	0.947
Barbados	37	0.903
Tanzania	151	0.530

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Germany	22	0.947
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Tanzania	151	0.530

Summary (1)

Favorable outcomes of diabetic foot disease in populations from industrialized nations seem to be closely linked to the presence and management of peripheral arterial disease, whereas uncontrolled infections appear to be the major problem in developing countries, as reflected by high amputation rates in the absence of evident vascular disease



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Summary (2)

Different hierarchy between industrialized and developing countries seems not only obvious for **(a) risk factors for** and **(b) outcome predictors of** diabetic foot lesions but might also be true for **(c) complications leading to the death of those patients**



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Summary (3)

The situation in threshold countries and newly industrialized countries, however, may contain aspects of both developing and industrialized nations

