DM & non-DM
manifestations of PAD

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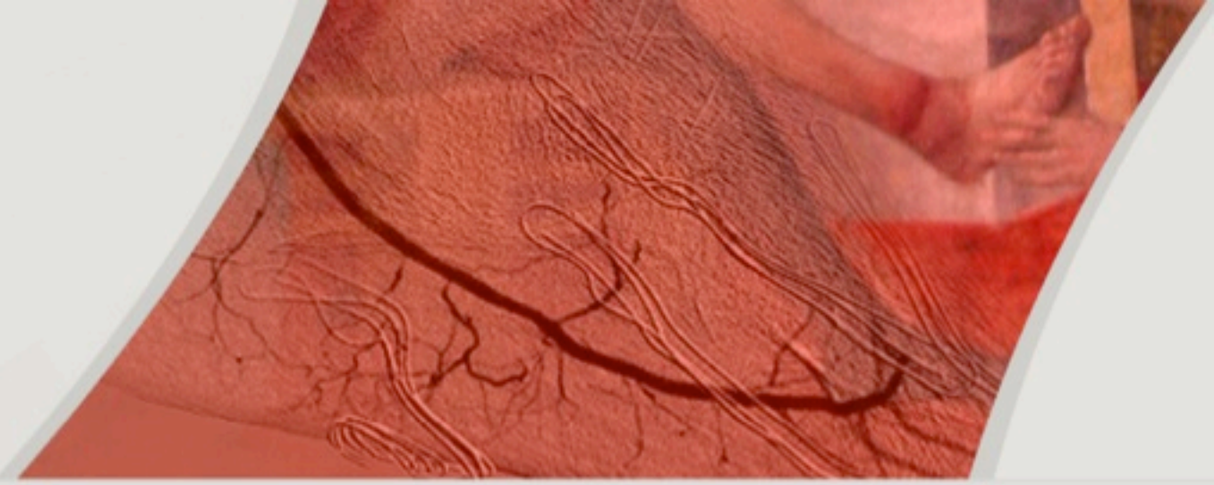
DM & non-DM

manifestations of PAD



PAD Classification & Stages

Fontaine (1954)

Rutherford (1991)

CLI and Ischemic Diabetic Foot today

PAD evolution in DM & non-DM

- Pathophysiology of CLI in DM patients
- DM patients and tissue lesions

Overview for DM & non-DM patients

DM vs non-DM manifestations of PAD

TASC
Inter-Society Consensus for the Management of PAD

Table D1. Classification of peripheral arterial disease: Fontaine's stages and Rutherford's categories

Fontaine		*Rutherford*		
Stage	*Clinical*	*Grade*	*Category*	*Clinical*
I	Asymptomatic	0	0	Asymptomatic
IIa	Mild claudication	I	1	Mild claudication
IIb	Moderate to severe claudication	I	2	Moderate claudication
		I	3	Severe claudication
III	Ischemic rest pain	II	4	Ischemic rest pain
IV	Ulceration or gangrene	III	5	Minor tissue loss
		III	6	Major tissue loss

asymptomatic

claudication

rest pain

tissue loss

DM vs non-DM manifestations of PAD

Fontaine	
Stage	*Clinical*
I	Asymptomatic
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René Fontaine (1899-1979)

Aus der chirurgischen Klinik Straßburg

Die chirurgische Behandlung der peripheren Durchblutungsstörungen

Von R. Fontaine, M. Kim und R. Kieny

Helv Chir Acta ***1954***;21:499.

asymptomatic

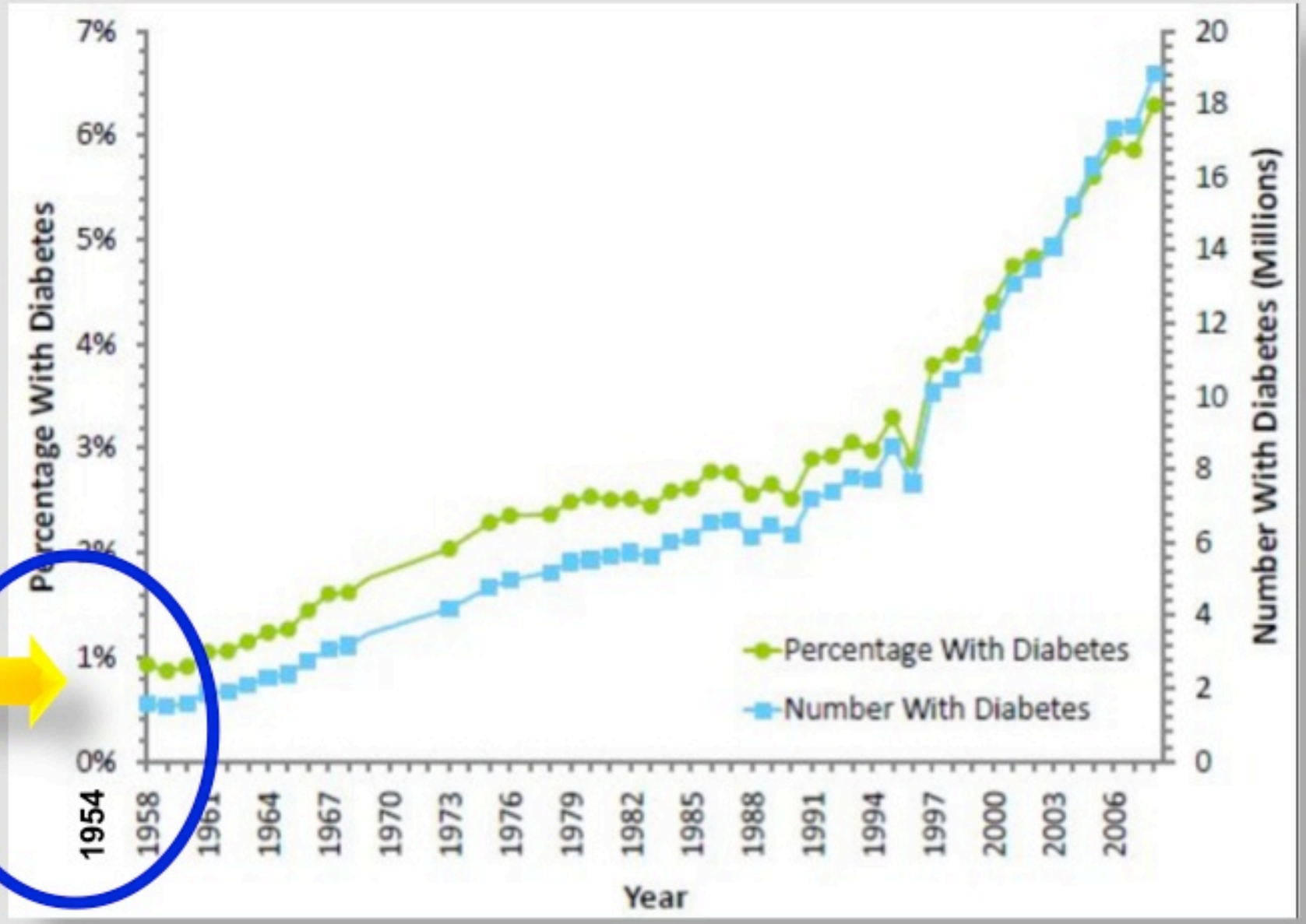
claudication

rest pain

tissue loss

DM vs non-DM manifestations of PAD

On 1954 prevalence of diabetes was <1%



Trends in the prevalence of diagnosed diabetes in the USA.
Data from the Centers for Disease Control and Prevention

asymptomatic

claudication

rest pain

tissue loss

DM vs non-DM manifestations of PAD

Robert B. Rutherford, MD • Gary J. Becker, MD

Standards for Evaluating and Reporting the Results of Surgical and Percutaneous Therapy for Peripheral Arterial Disease[1]

Journal of Vascular and Interventional Radiology (JVIR) **1991**;2:169-174

Rutherford		
Grade	*Category*	*Clinical*
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asymptomatic

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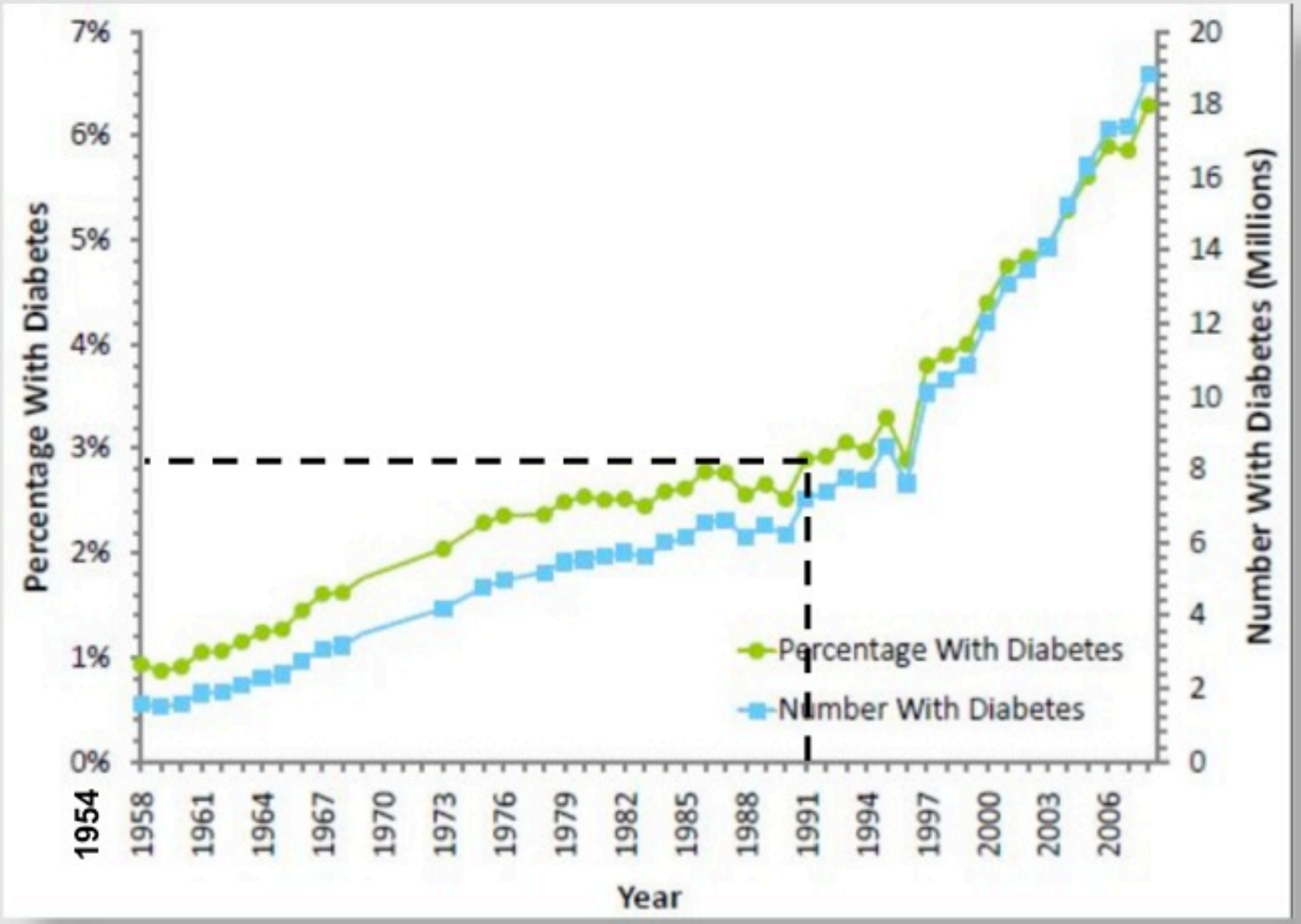
DM vs non-DM manifestations of PAD

On 1991 prevalence of diabetes was <3%



Trends in the prevalence of diagnosed diabetes in the USA.
Data from the Centers for Disease Control and Prevention

asymptomatic

claudication

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DM vs non-DM manifestations of PAD

Fontaine and Rutherford classifications of PAD describe the clinical manifestations of the disease in non-diabetic patients

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Non-diabetics

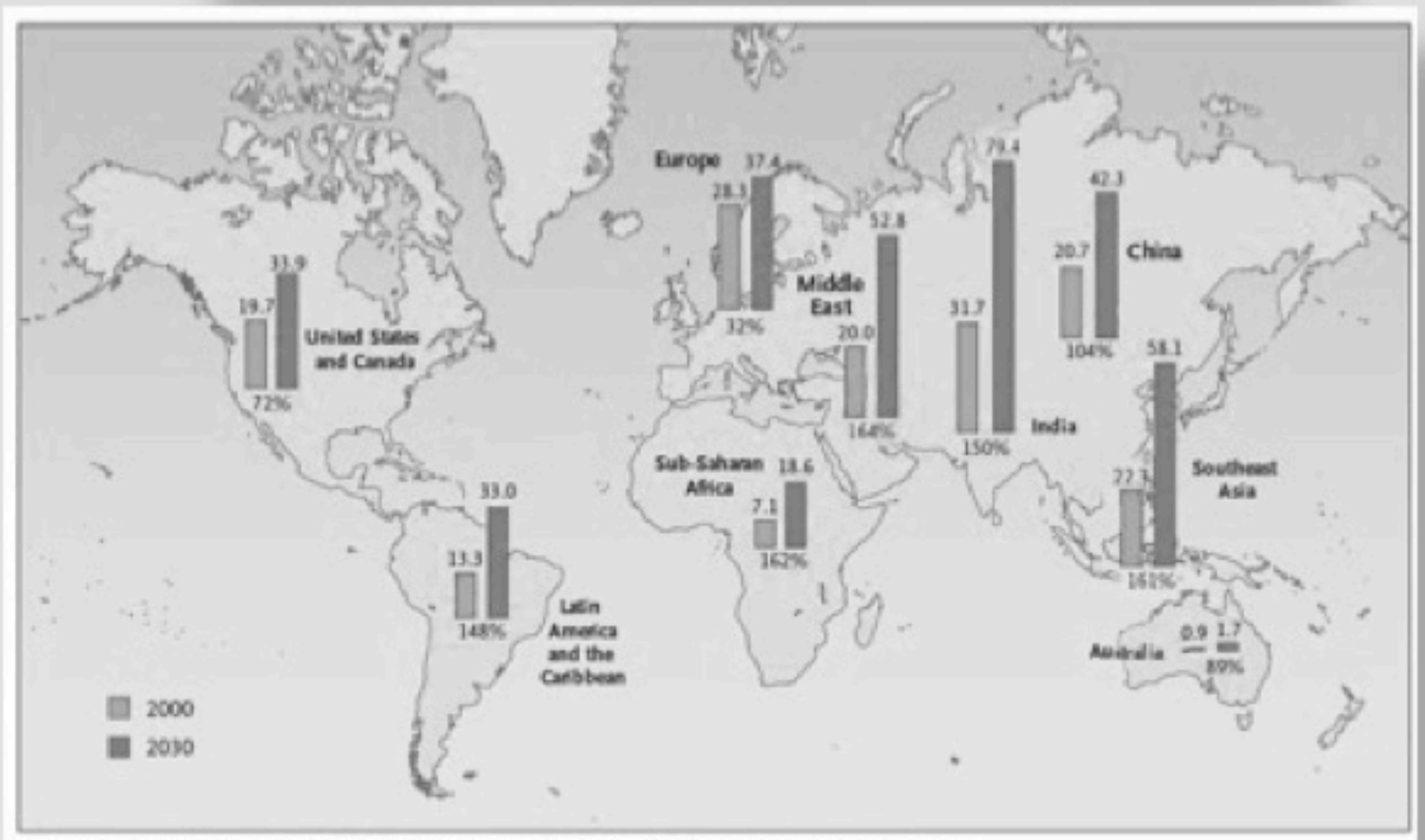
asymptomatic

claudication

rest pain

tissue loss

PROGRESSION OF DIABETES MELLITUS IN THE WORLD



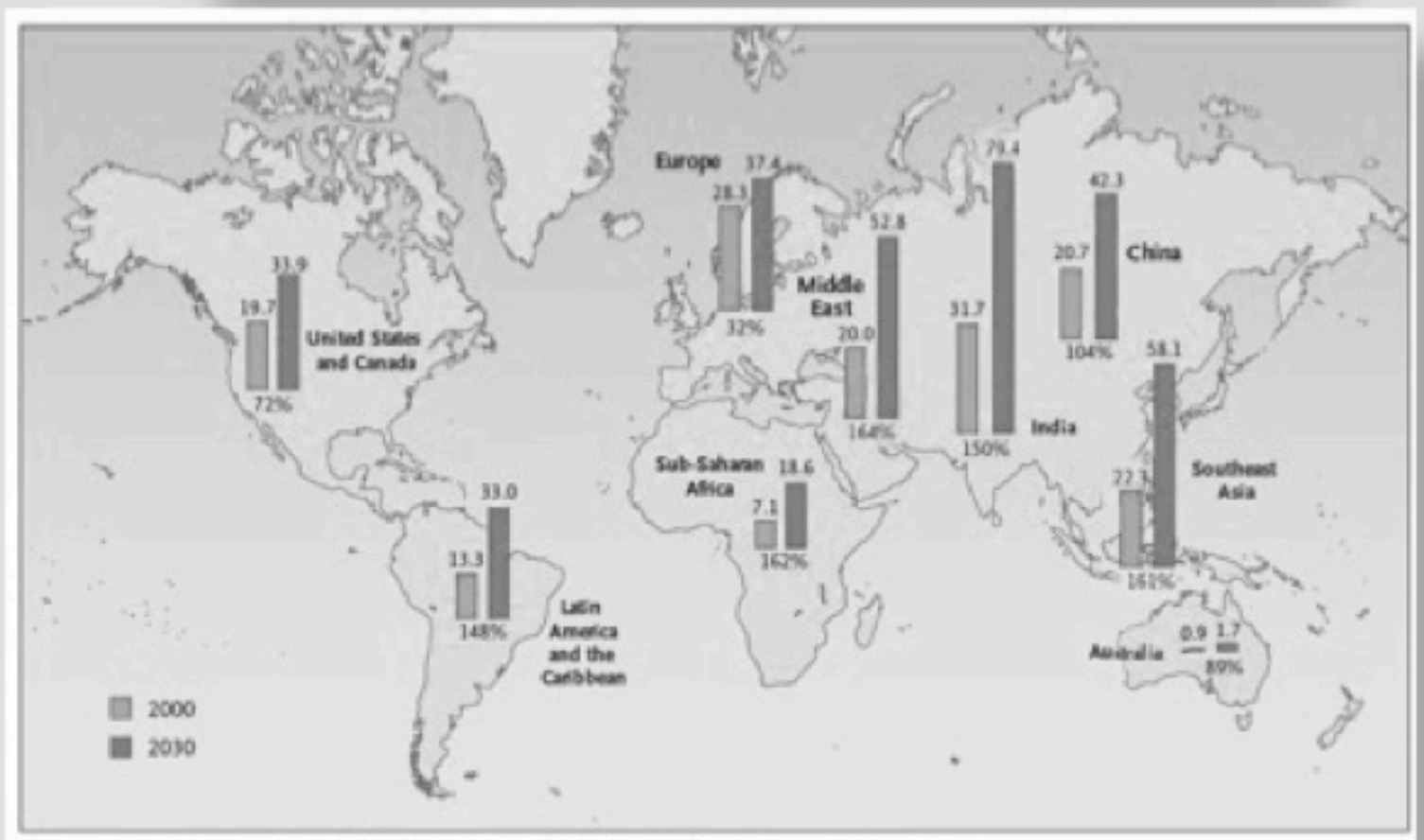
Millions of Cases of Diabetes in 2000 and Projections for 2030, with Projected Percent Changes.

Modified from: ***Wild S, et Al. Diabetes Care 2004;27:1047-53***

60% or more of CLI pts are diabetic

source: THE SAGE GROUP, LLC
CRITICAL LIMB ISCHEMIA
UNITED STATES EPIDEMIOLOGY

PROGRESSION OF DIABETES MELLITUS IN THE WORLD



Millions of Cases of Diabetes in 2000 and Projections for 2030, with Projected Percent Changes.

Modified from: ***Wild S, et Al. Diabetes Care 2004;27:1047-53***

Today the world is facing an epidemic of diabetes:

CLI = ischemic diabetic foot

DM vs non-DM manifestations of PAD

Vascular Medicine 2001; 6: 77–80

Claudication does not always precede critical leg ischemia

Sorjo Mätzke and Mauri Lepäntalo

"Although this logical course of the disease is intellectually appealing, not all patients with CLI have experienced any symptoms of previous claudication."

asymptomatic

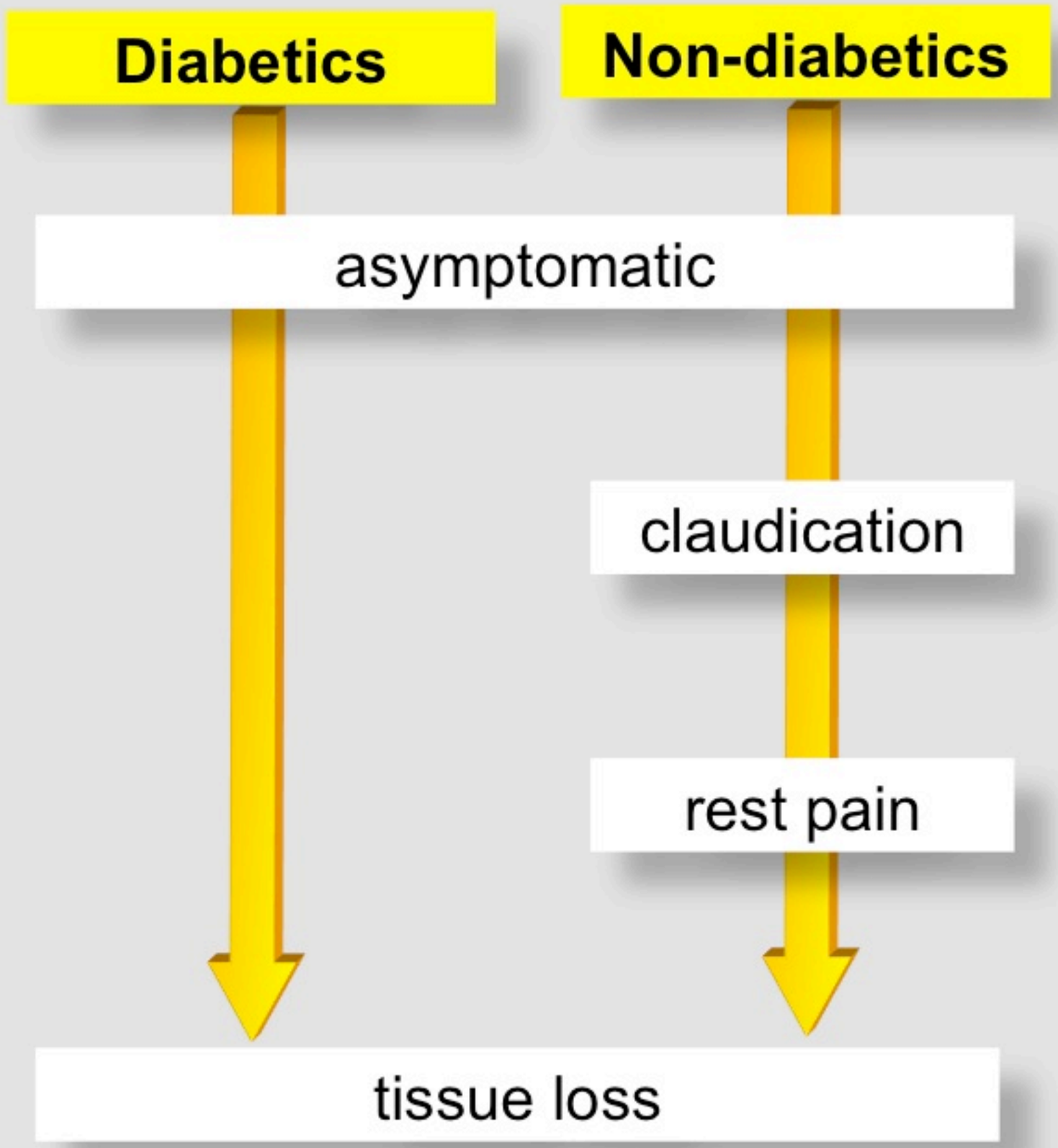
claudication

rest pain

tissue loss

DM vs non-DM manifestations of PAD

PAD evolution is often different, especially in diabetics!



DM vs non-DM manifestations of PAD

Endocrine (2012) 41:384–397
DOI 10.1007/s12020-012-9619-x

REVIEW

Diagnostics and treatment of the diabetic foot

Jan Apelqvist

Diabetics

Non-diabetics

asymptomatic

claudication

rest pain

tissue loss

“ …<25% of diabetics with PAD report intermittent claudication, and in DM pts with foot ulcers rest pain is substantially less frequent than in non-DM pts…”

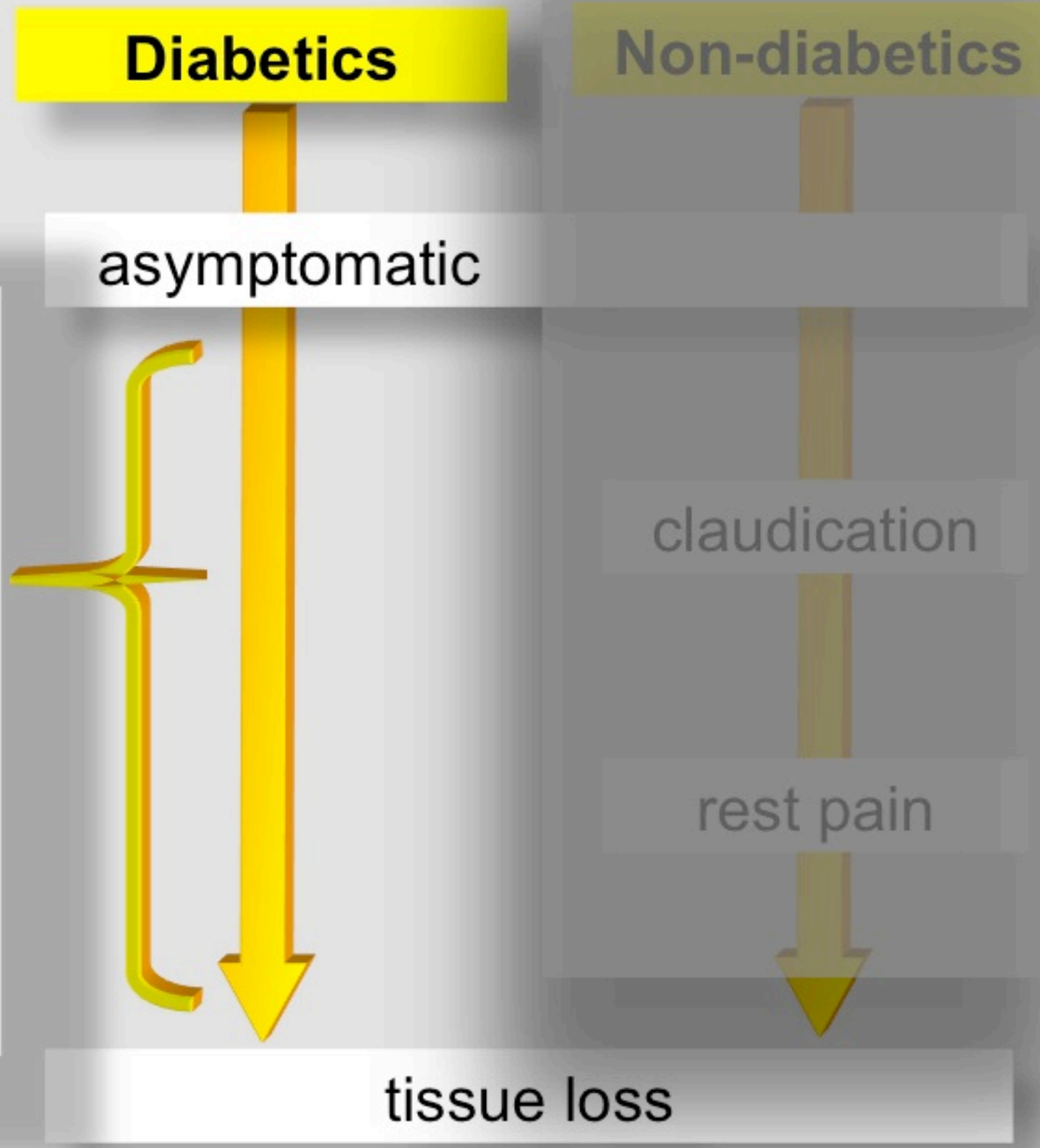
Pathophysiology of diabetic-CLI

PAD in diabetics is precocious, multilevel (FEM-POP, BTK, FOOT) and aggressive. We can suppose that year after year PAD is growing up in apparently asymptomatic legs.

According to TASC II, in these patients we have “chronic subclinical ischemia”, not claudication.

I prefer the term of **foot hibernation:**

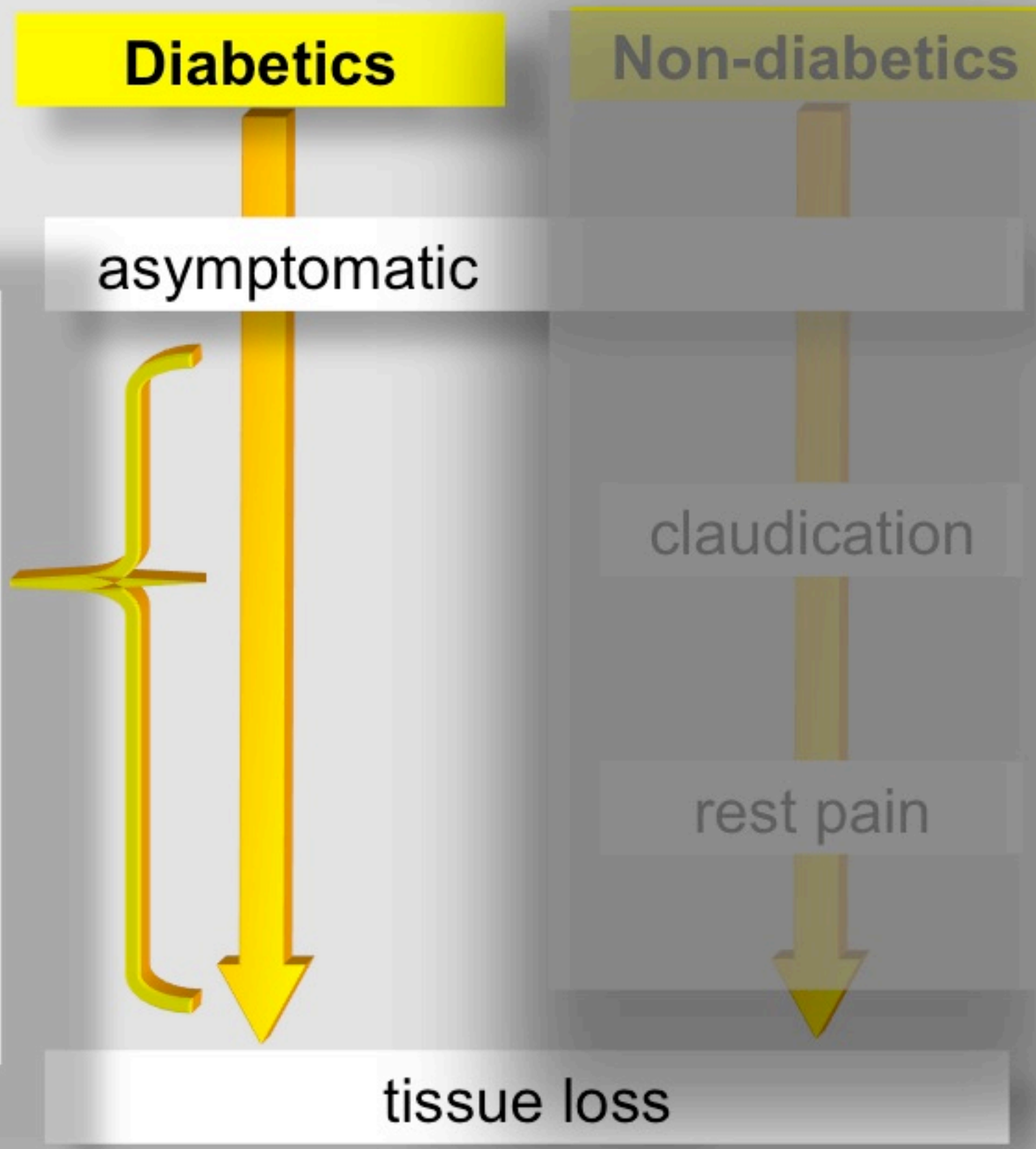
- impaired energy use
- hypotermia
- hypotrophic skin & muscles, and
- progressive neurological & orthopedical abnormalities.



Pathophysiology of diabetic-CLI

Foot hibernation/Subclinical chronic ischemia

- Chronic vascular disease: blood flow is reduced but sufficient to keep the limb asymptomatic
- Foot: viability but low functional capacity
- Patients are not aware of the problem because of:
  - ❑ **Obesity → sedentary**
  - ❑ **Retinopathy → sedentary**
  - ❑ **CAD → low functional capacity**
  - ❑ **Neuropathy → no pain!!!**



Pathophysiology of diabetic-CLI

Why do diabetic patients develop tissue lesions?

Pathophysiology of diabetic-CLI

In diabetic pts the onset of CLI is often a ***mechanical trauma*** due to sensory neuropathy, not a purely ischemic event.

Due to neuropathy the patient does not feel the foot, so can easily damage it because of:

- Foot deformity creating peak pressure zones
- Nonprotective shoes, foreign bodies
- Hot water (burns)
- Incorrect nail care

Pathophysiology of diabetic-CLI

Comprehensive Foot Examination and Risk Assessment

A report of the Task Force of the Foot Care Interest Group of the American Diabetes Association, with endorsement by the American Association of Clinical Endocrinologists.

Diabetes Care, Volome 31, Number 8. August 2008

THE PATHWAY TO FOOT ULCERATION

"The lifetime risk of a person with diabetes developing a foot ulcer may be as high as 25%, whereas the annual incidence of foot ulcers is about 2%. Up to 50% of older patients with type 2 diabetes have one or more risk factors for foot ulceration. A number of component causes, most importantly peripheral neuropathy, interact to complete the causal pathway to foot ulceration.

The most common triad of causes that interact and ultimately result in ulceration has been identified as neuropathy, deformity, and trauma."

Pathophysiology of diabetic-CLI

When there is a skin lesion the door is open for infection.

<u>Infection is the main cause of amputation in ischemic diabetic foot:</u> abscess, phlegmon, necrotizing fasciitis, osteomyelitis.

Infection means:

- Increased O_2 consumption
- Reduced O_2 extraction due to tissue/perfusion mismatch
- Septic arteritis (arteriolar microthrombosis)
- Increased arteriovenous shunting

Pathophysiology of diabetic-CLI

In animal models femoral artery blood flow increases 3-7 times in infected limbs: infection reduces peripheral resistance.

We can compare infection-related ischemia to the discrepancy ischemia of the heart: infection is a foot stress test because healing is a blood

flow-dependent process.

Cronenwett JL, Lindenauer SM. Direct measurement of arteriovenous anastomotic blood flow in the septic canine hindlimb. Surgery 1979;85:275-82

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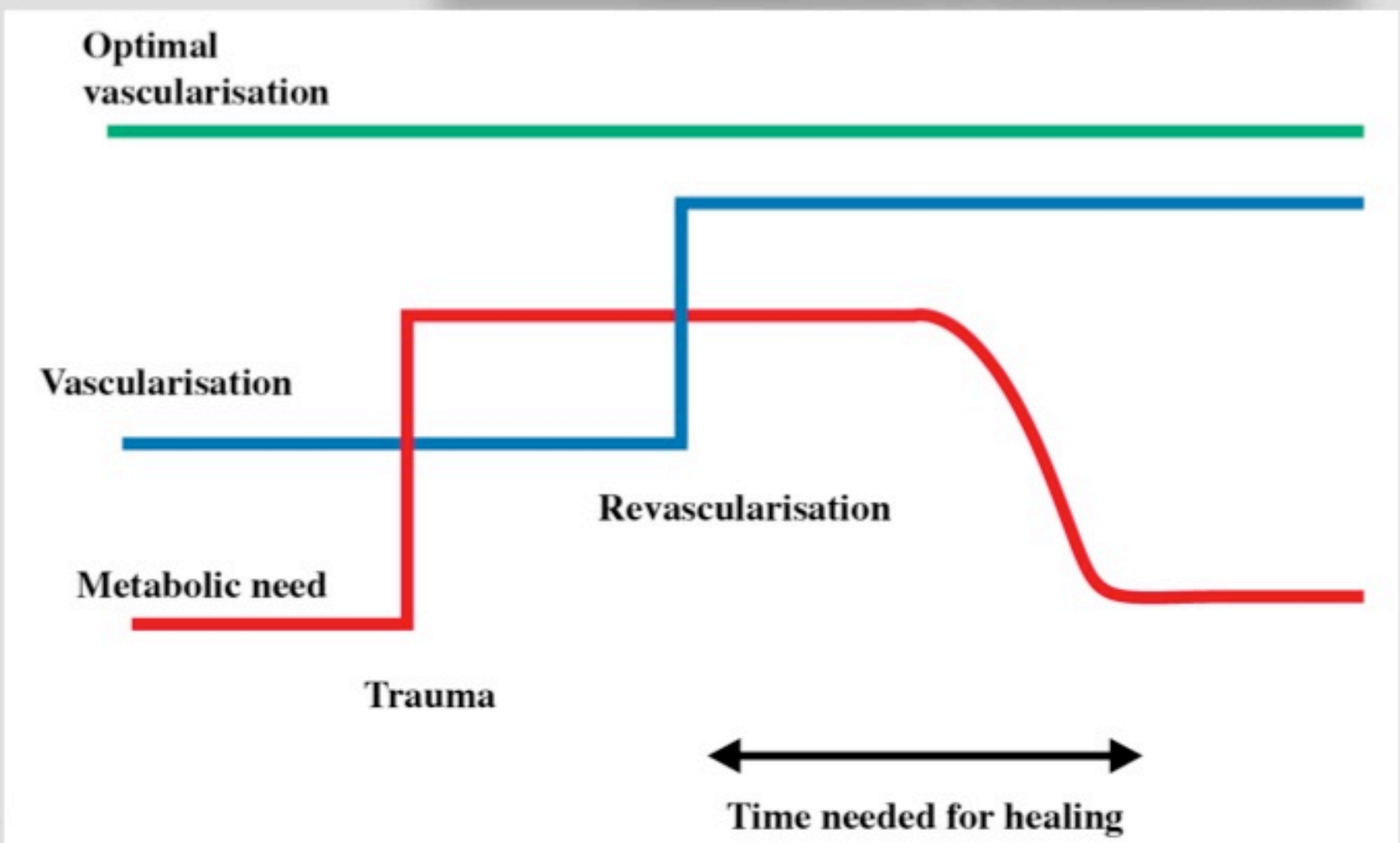
Pathophysiology of diabetic-CLI

Modified from: *F. Vermassen 2010*



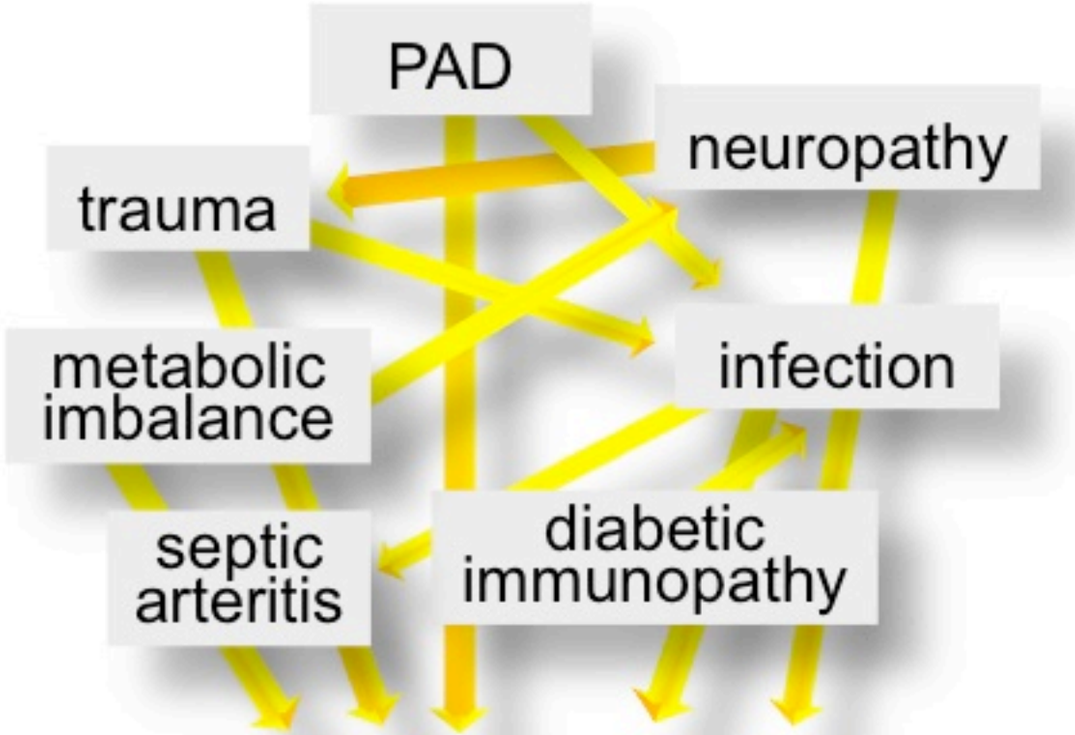
Suboptimal perfusion makes tissue vulnerable

- Increased blood flow is required for wound healing, beyond the basal metabolic need
- Trauma & infection trigger immediate need of incremental flow

Pathophysiology of diabetic-CLI

Diabetics

Complex disease: PAD evolution is frequently silent (hybernated foot)



Non-Diabetics

Simple disease: it needs only ability to walk & PAD evolution!