

DIAGNOSIS OF DIABETIC NEUROPATHY

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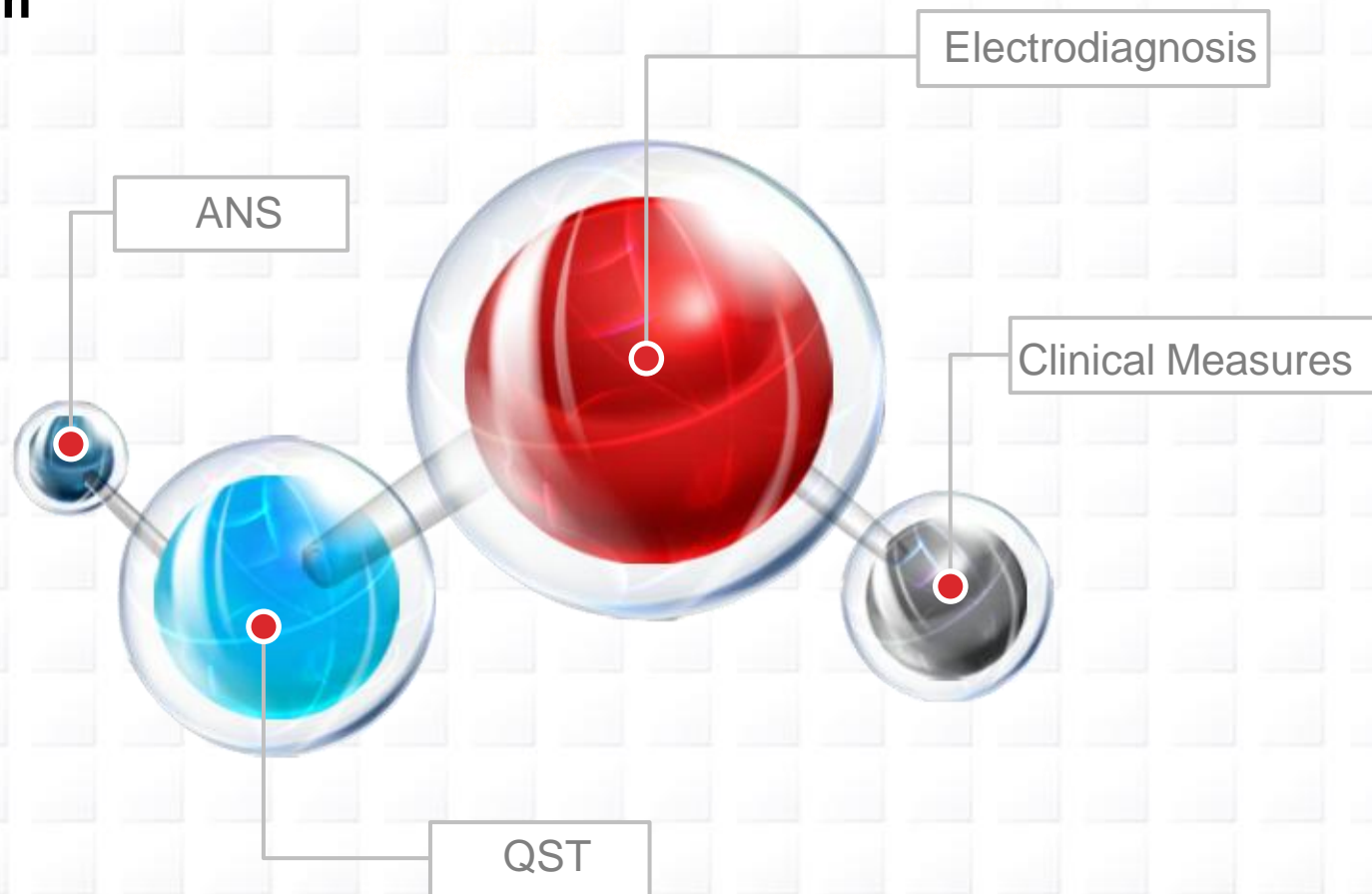
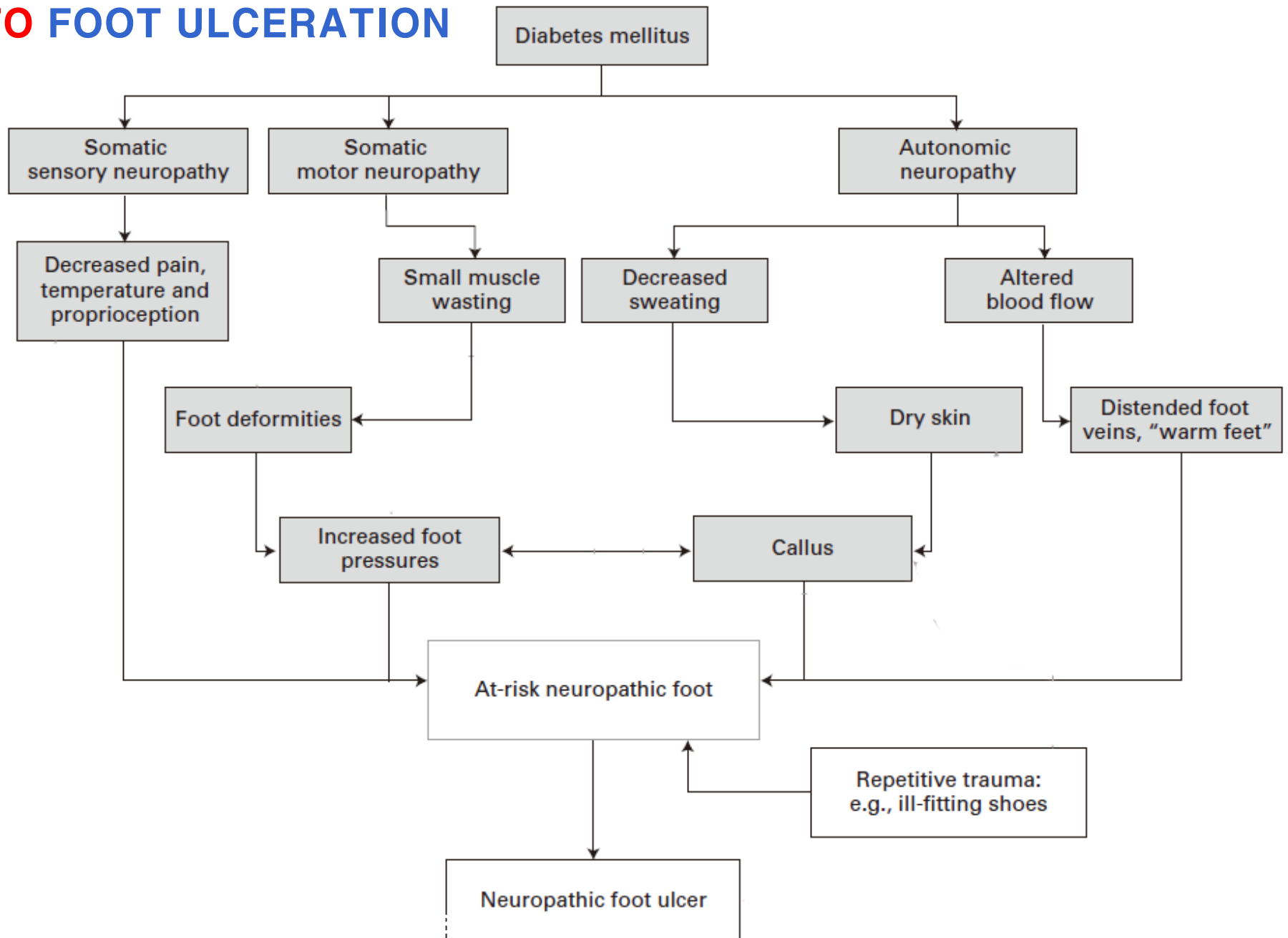


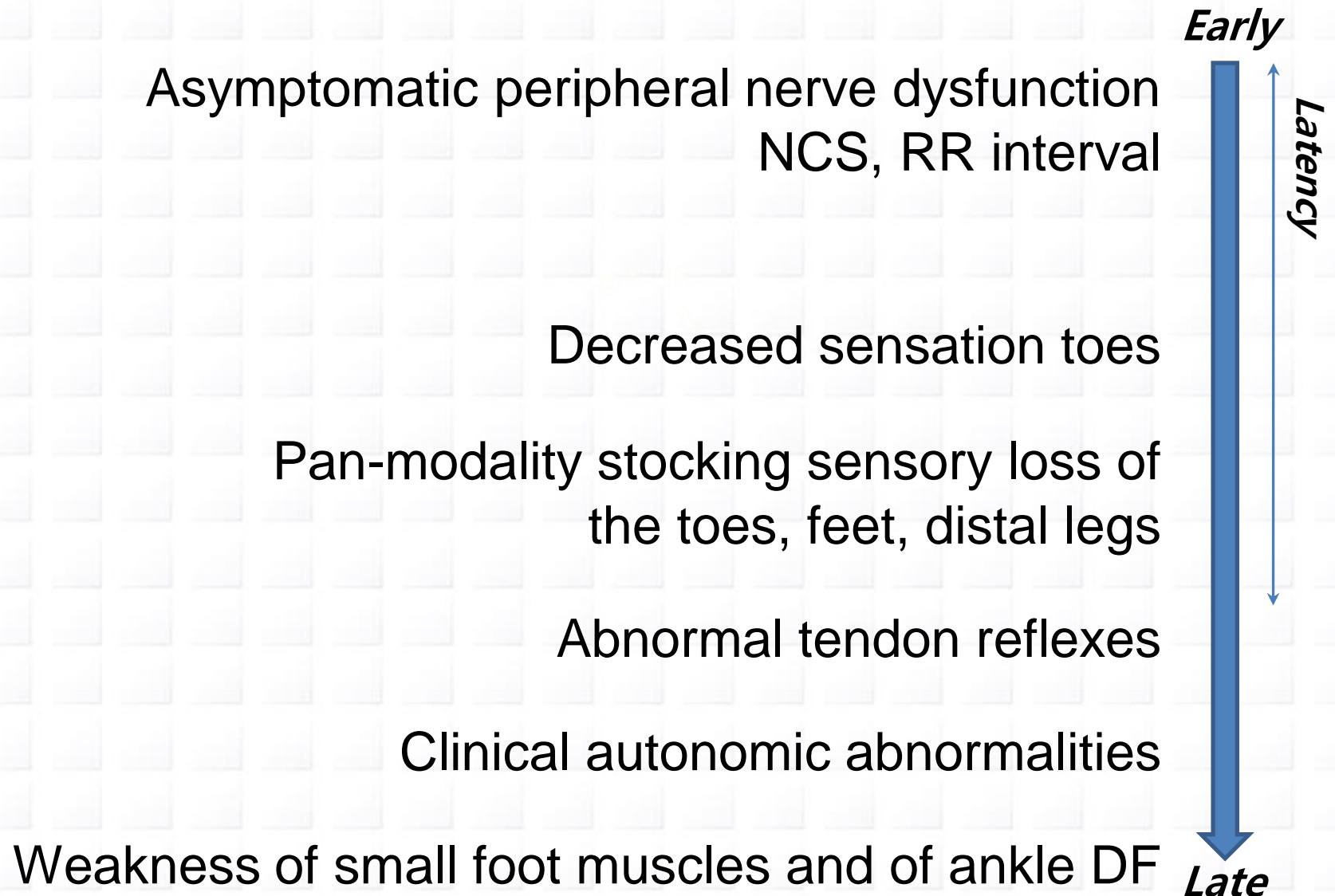
DIAGRAM OF CASUAL PATHWAYS TO FOOT ULCERATION



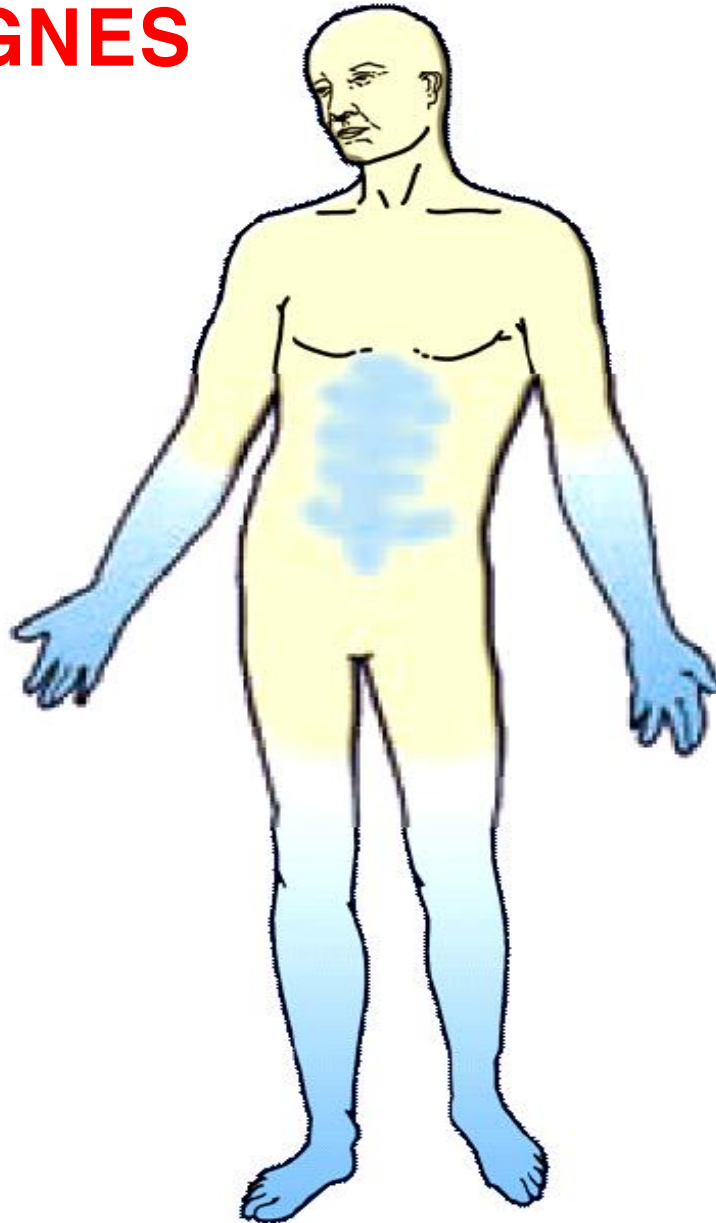
DIABETIC PERIPHERAL NEUROPATHY

- the M/C complication of diabetes
- Prevalence: 28% (UK); 66% (Rochester, Minn., USA)
- ↑ the burden in health care costs
- up to 70% of all leg amputations
- 26%, painful diabetic neuropathy;
13%, no Sxs; 39%, no treatment
- prediabetes or IGT: ↑ rates of neuropathy;
a 2-3 fold ↑ in neuropathic pain

CHANGES OF SIGNS



SENSORY CHANGES



DEFINITION OF DIABETIC PERIPHERAL NEUROPATHY

Somatic and/or autonomic neuropathy
that is attributed solely to diabetes mellitus

Generalized symmetric polyneuropathies

- Acute sensory
- Chronic sensorimotor
- Autonomic

Focal and multifocal neuropathies

- Cranial
- Truncal
- Focal limb
- Proximal motor (amyotrophy)
- Coexisting CIDP

CLASSIFICATION OF DIABETIC PERIPHERAL NEUROPATHY

Generalized polyneuropathies

- **Typical DPN** (diabetic sensorimotor polyneuropathy)
- **Atypical DPN**

Focal & multifocal neuropathies

- **Focal neuropathy:** median, ulnar, peroneal nerves
- **Multifocal neuropathies:** multiple mononeuropathies
radiculoplexus neuropathies

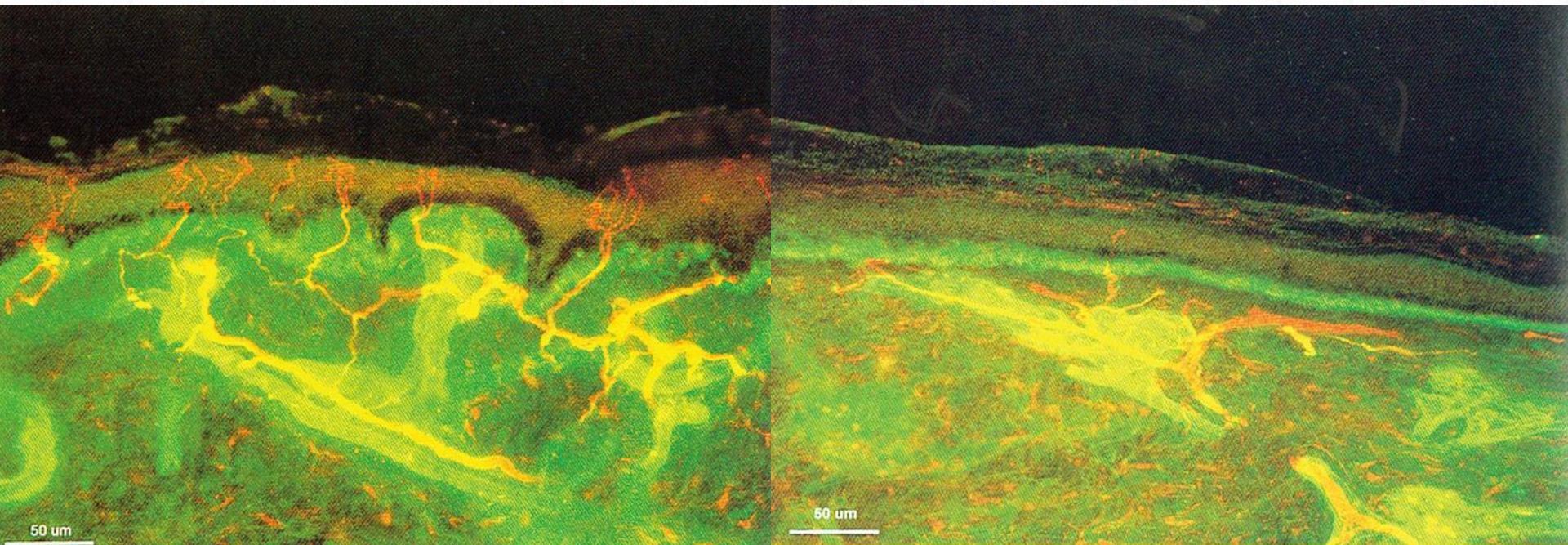
ASSESSMENT OF DIABETIC PERIPHERAL NEUROPATHY

- 1. Clinical symptoms & signs**
- 2. Electrodiagnostic studies**
- 3. Quatitative sensation testing**
- 4. Autonomic function testing**

cf) nerve biopsy,

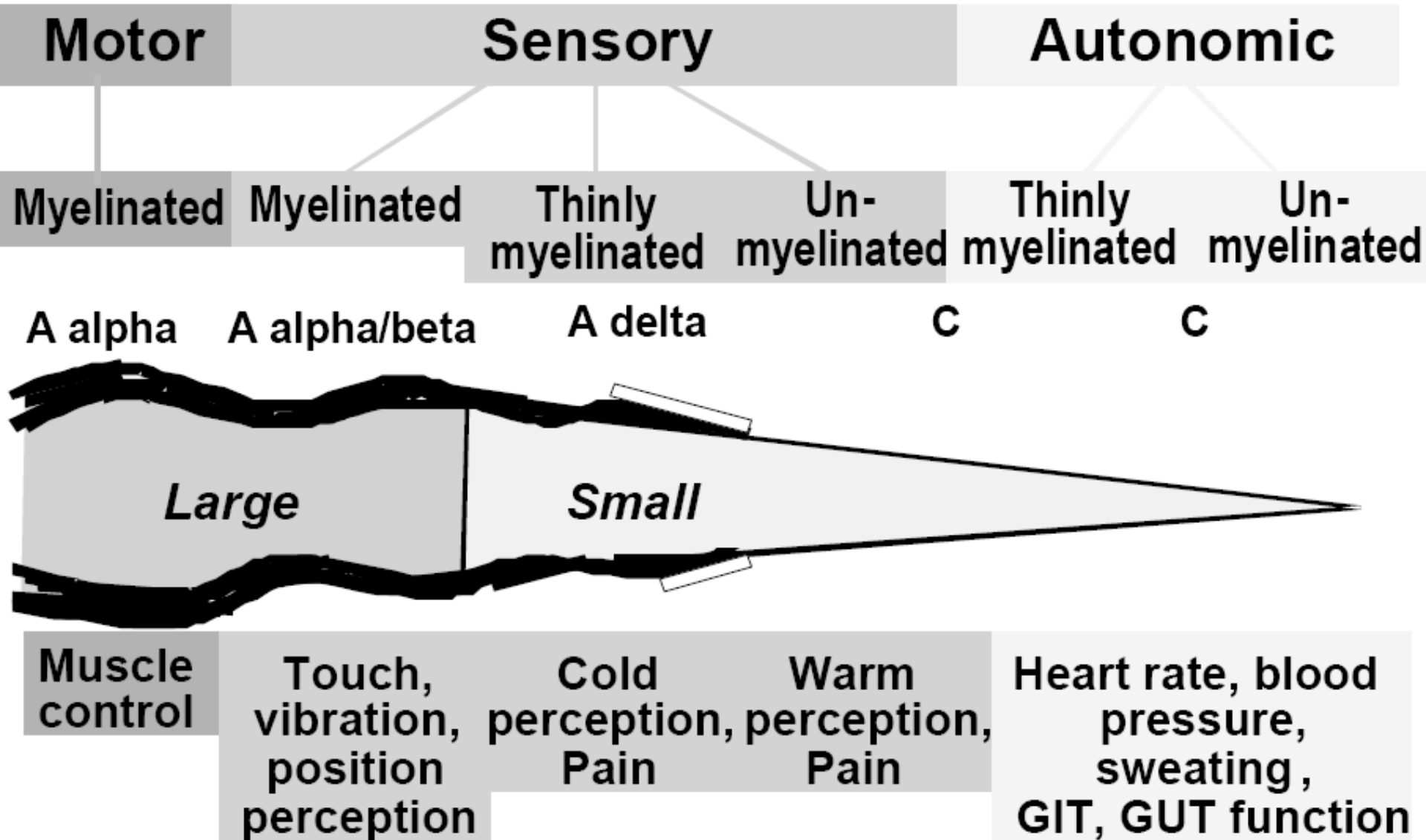
skin biopsy: small fiber neuropathy

ASSESSMENT OF DIABETIC PERIPHERAL NEUROPATHY

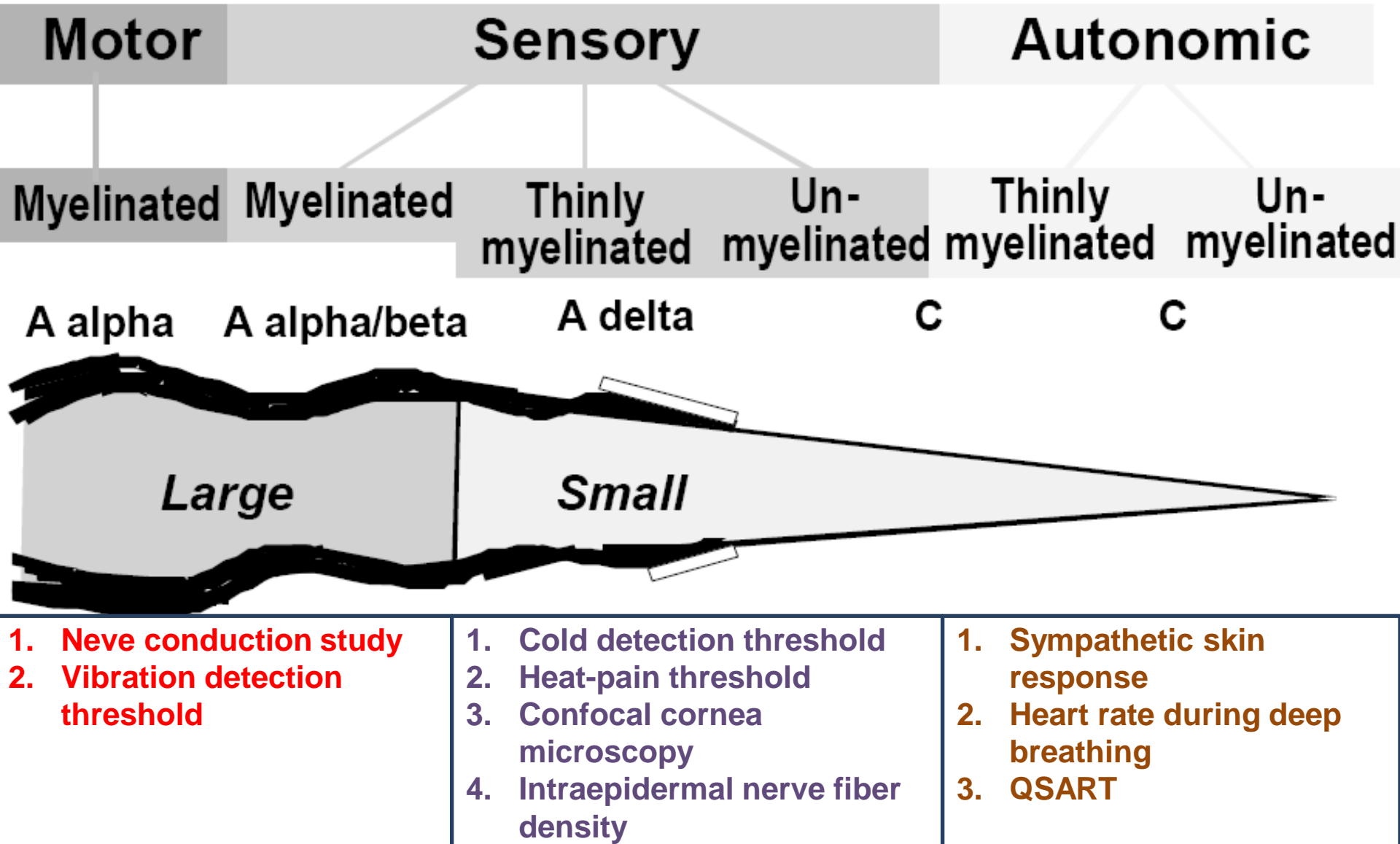


cf) nerve biopsy,
skin biopsy: small fiber neuropathy

PERIPHERAL NERVOUS SYSTEM



PERIPHERAL NERVOUS SYSTEM



CONSENSUS FOR DIABETIC PERIPHERAL NEUROPATHY

- The 1988 San Antonio Conference on Diabetic Neuropathy
(Diabetes Care 1988;11:592-597)

Report and Recommendations
of the San Antonio Conference
on Diabetic Neuropathy*

- Boulton et al.
(Diabetes Care 2005;28:956-962)

Diabetic Neuropathies

A statement by the American Diabetes Association

- AAN, AANEM, and AAPM&R
(Neurology 2005;64:199-207)

Distal symmetric polyneuropathy: A definition for clinical research

Report of the American Academy of Neurology, the
American Association of Electrodiagnostic Medicine, and
the American Academy of Physical Medicine and
Rehabilitation

- The 2009 Toronto Conference on Diabetic neuropathy
(Diabetes Care 2010;33:2285-2293)

Diabetic Neuropathies: Update on Definitions, Diagnostic Criteria, Estimation of Severity, and Treatments

MAKING THE DIAGNOSIS OF DIABETIC PERIPHERAL NEUROPATHY

| Neuropathic symptoms | Decreased or absent ankle reflex | Decreased distal sense | Distal m. weakness or atrophy | NCSs | Ordinal likelihood |
|----------------------|----------------------------------|------------------------|-------------------------------|-----------------|--------------------|
| Present | Present | Present | Present | Abnormal | +++++ |
| Absent | Present | Present | Present | Abnormal | +++++ |
| Present | Present | Present | Absent | Abnormal | +++++ |
| Present | Present | Absent | Absent | Abnormal | +++++ |
| Present | Absent | Present | Absent | Abnormal | +++++ |
| Absent | Present | Absent | Present | Abnormal | +++ |
| Present | Absent | Absent | Absent | Abnormal | +++ |
| Absent | Absent | Absent | Absent | Abnormal | ++ |
| Absent | Present | Absent | Absent | Abnormal | ++ |
| Present | Present | Present | Absent | Normal | ++ |
| Present | Absent | Present | Absent | Normal | + |
| present | present | Present | present | Normal | - |

MAKING THE DIAGNOSIS OF DIABETIC PERIPHERAL NEUROPATHY

The Gold Standard of Diagnosis



Symptoms + Signs + Abnormal NCS

(England JD, et al. Neurology 2005;64:199-207)



The most reliable diagnosis and selection of patients
for research studies

DEFINITIONS OF MINIMAL CRITERIA FOR DIABETIC PERIPHERAL NEUROPATHY

1. **Possible DSPN:** symptoms or signs of DSPN
2. **Probable DSPN:** symptoms & signs of DSPN
3. **Confirmed DSPN:** abnormal NCs
+ a symptom or symptoms,
or a sign or signs

Clinical
practice

4. **Subclinical DSPN**

: abnormal NCs or a validated measure of SFN
with no signs or symptoms

Research
studies

GUIDELINES FOR DIABETIC PERIPHERAL NEUROPATHY

1. Studies of the epidemiology of peripheral and autonomic diabetic neuropathy
2. Conduct of clinical trials in diabetic neuropathy
3. Management of diabetic peripheral neuropathy by practising clinicians

➔ International Guidelines on the Out-patient
Management of Diabetic Peripheral Neuropathy (1995)

SCREENING FOR DIABETIC PERIPHERAL NEUROPATHY

- The International Guidelines for Diagnosis and Outpatient Management of Diabetic Peripheral Neuropathy
(The neuropathy study group [Neurodiab] of the European Association for the Study of Diabetes [EASD], 1995)
- Guidelines for diagnosis and outpatient management of diabetic peripheral neuropathy. European Association for the Study of Diabetes, Neurodiab.
(Boulton AJ. [Diabetes Metab.](#) 1998;24 Suppl 3:55-65)
- International consensus on the diabetic foot
(International Working Group on the Diabetic foot, 1999, 2007)
- The Clinical Practice Guidelines of the Canadian Diabetes Mellitus
(Canadian J Diabetes, 2008)



DIABETES/METABOLISM RESEARCH AND REVIEWS
Diabetes Metab Res Rev 2008; 24(Suppl 1): S181-S187.
Published online in Wiley InterScience (www.interscience.wiley.com) DOI: 10.1002/dmrr.848

Practical guidelines on the management and prevention of the diabetic foot

Based upon the International Consensus on the Diabetic Foot (2007)
Prepared by the International Working Group on the Diabetic Foot

Canadian Journal of Diabetes

Canadian Diabetes Association
2008 Clinical Practice Guidelines
for the Prevention and Management
of Diabetes in Canada

2013 ADA RECOMMENDATIONS FOR NEUROPATHY SCREENING

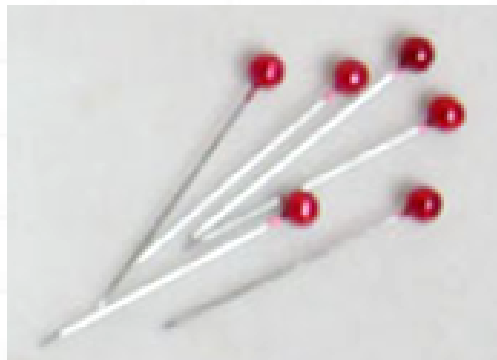
- All patients should be screened for distal symmetric polyneuropathy (DPN) starting **at diagnosis of type 2 diabetes** and **5 years after the diagnosis of type 1 diabetes** and **at least annually thereafter**, using simple clinical tests. (B)
- Electrophysiological testing is rarely needed, except in situations where the clinical features are atypical. (E)
- Screening for signs and symptoms of cardiovascular autonomic neuropathy (CAN) should be instituted **at diagnosis of type 2 diabetes** and **5 years after the diagnosis of type 1 diabetes**. Special testing is rarely needed and may not affect management or outcomes. (E)

SCREENING NEUROLOGICAL TESTS FOR DIABETIC PERIPHERAL NEUROPATHY

- **Pinprick sensation:** a disposable dressmaker's pin
- **Vibration perception:** a 128-Hz tuning fork
- **Pressure sensation:** 10-g Semmes-Weinstein monofilament
- **Ankle reflex:** reflex hammer

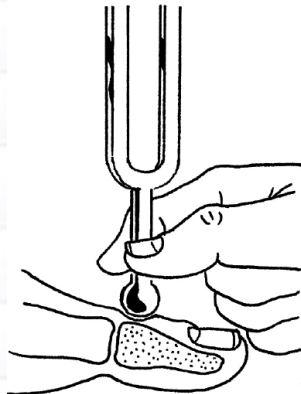
SCREENING NEUROLOGICAL TESTS FOR DIABETIC PERIPHERAL NEUROPATHY

- **Pinprick sensation:** a disposable dressmaker's pin
 - Ask "Is it painful?" not "Can you feel it?"
 - Sites: dorsum of great toe or
the plantar aspect of the distal 1st, 3rd, and 5th toes
 - highly subjective, poorly reproducible



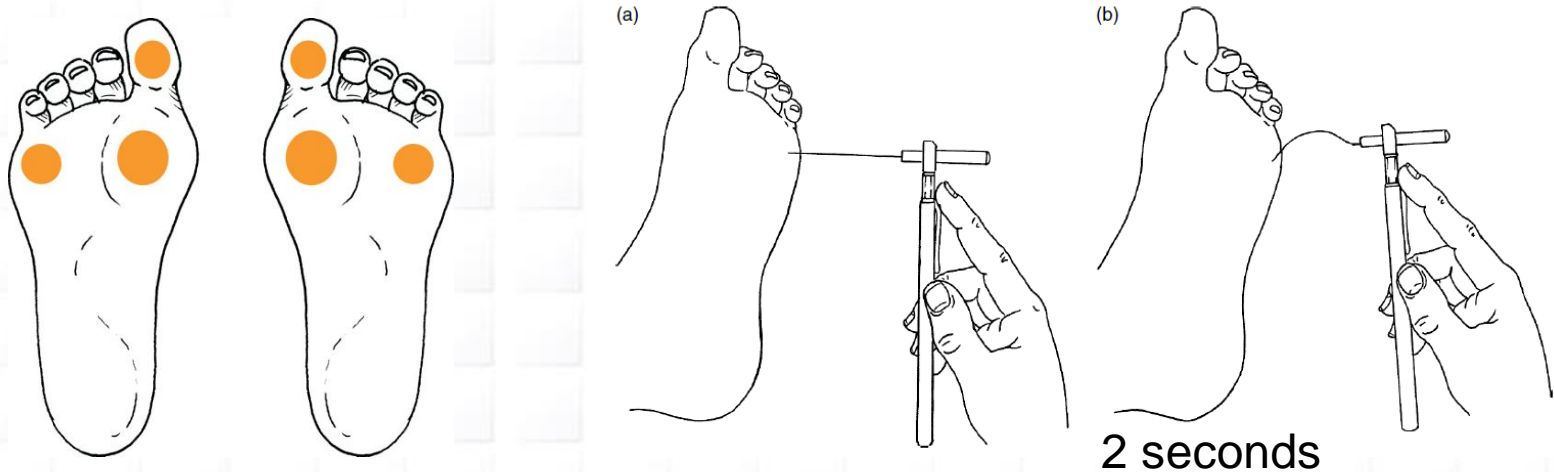
SCREENING NEUROLOGICAL TESTS FOR DIABETIC PERIPHERAL NEUROPATHY

- **Vibration perception:** a 128-Hz tuning fork
 - wrist (or elbow or clavicle) → 1st toes
 - two true application + one “mock” application
- a highly subjective and poorly reproducible,
but significantly associated with development of foot ulcers



SCREENING NEUROLOGICAL TESTS FOR DIABETIC PERIPHERAL NEUROPATHY

- **Pressure sensation:** 10-g Semmes-Weinstein monofilament
 - hands (or elbow or forehead) → three sites (1st toe, forefoot)
 - two true application + one “mock” application (yes or no)
- ➔ the best correlate to the presence or history of an ulcer
- forefoot: moderate reproducibility ($\kappa=0.38-0.54$)



SCREENING NEUROLOGICAL TESTS FOR DIABETIC PERIPHERAL NEUROPATHY

- **Ankle reflex:** reflex hammer
 - both ankles, sitting or kneeling
 - no reflex → repeat with reinforcement
 - grade: 0, absent; 1, present but decreased;
2, normal; 3, increased; 4, increased with clonus
 - a poor predictor of ulceration



Modified Neuropathy Disability Score (NDS)

| Neuropathy Disability Score (NDS) | | | |
|---|--|-------|------|
| | | Right | Left |
| Vibration Perception Threshold 128-Hz tuning fork; apex of big toe: normal = can distinguish vibrating/ not vibrating | Normal = 0 Abnormal = 1 | | |
| Temperature Perception on Dorsum of the Foot Use tuning fork with beaker of ice/warm water | | | |
| Pin-Prick Apply pin proximal to big toe nail just enough to deform the skin; trial pair = sharp, blunt; normal = can distinguish sharp/not sharp | | | |
| Achilles Reflex | Present = 0 Present with reinforcement = 1 Absent = 2 | | |
| | NDS Total out of 10 | | |

SCREENING NEUROLOGICAL TESTS FOR DIABETIC PERIPHERAL NEUROPATHY

- Combinations of more than one test have 87% sensitivity in detecting DPN.
- Loss of 10-g monofilament perception and reduced vibration perception predict foot ulcers.

EARLY RECOGNITION AND MANAGEMENT OF NEUROPATHY

- Nondiabetic neuropathy... treatable
- a number of treatment option
- up to 50% of diabetic peripheral neuropathy... asymptomatic
→ at risk for insensate injury to feet
- autonomic neuropathy and cardiac autonomic neuropathy
... substantial morbidity and even mortality

Thank You for Your Attention

