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IR thermography diagnostic application in Diabetes Mellitus induced periphery arteries disease

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Forum is part – financed by Podlaskie Region

IR thermography diagnostic application in DM induced periphery arteries disease

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Diabetes Mellitus

DM is an incurable lifelong disease characterized by persistent hypoglycemia

It is a multisystem disease with wide ranging and devastating complications which end up in severe disability and death

Diabetes prevalence

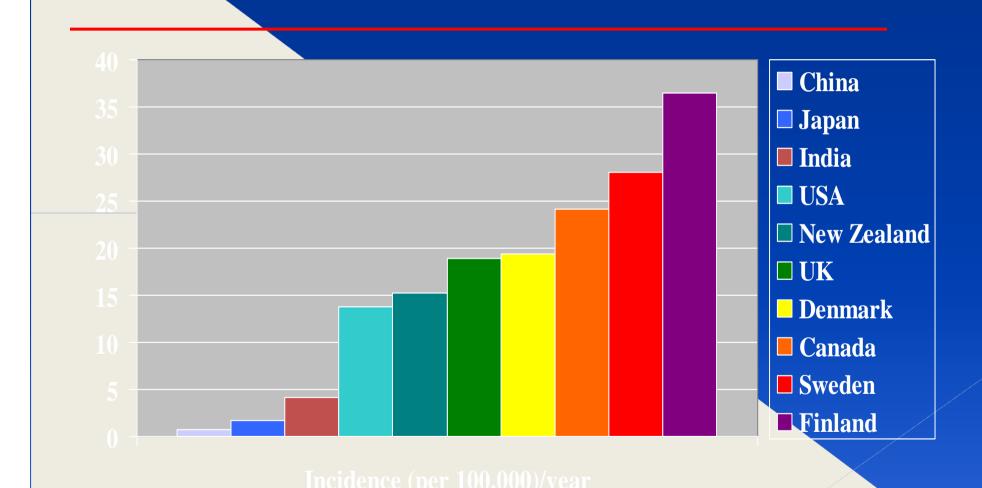
Diabetes has world wide distribution seen in developed countries; about 6 million people in USA have diabetes; additional 4-5 million have undiagnosed diabetes.



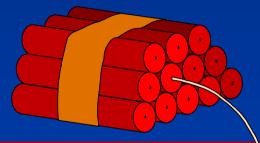
Diabetes prevalence

The International Diabetes Federation reported the prevalence of diabetes at 6% in the adult population aged 20-79years. Consequently it means, that we have over 30 millions of diabetes patients in 27 EU countries. About of 600,000 diabetic foot ulcers occur each year and 90,000 of them required amputation. Its directly associate with poor life quality and high treatment costs and long hospitalization.

Incidence of type 1 diabetes Age 0-14 years



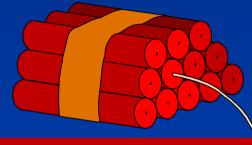
Magnitude of problem



- Diabetics are at 50% increased morbidity and mortality
- Diabetes is responsible for about 38,000 deaths each year in USA
- Diabetics are 25 times more likely to develop blindness
- 7 times more likely to develop renal disease
- 20 times more likely to develop gangrene
- 2 times more likely to develop heart disease or suffer stroke



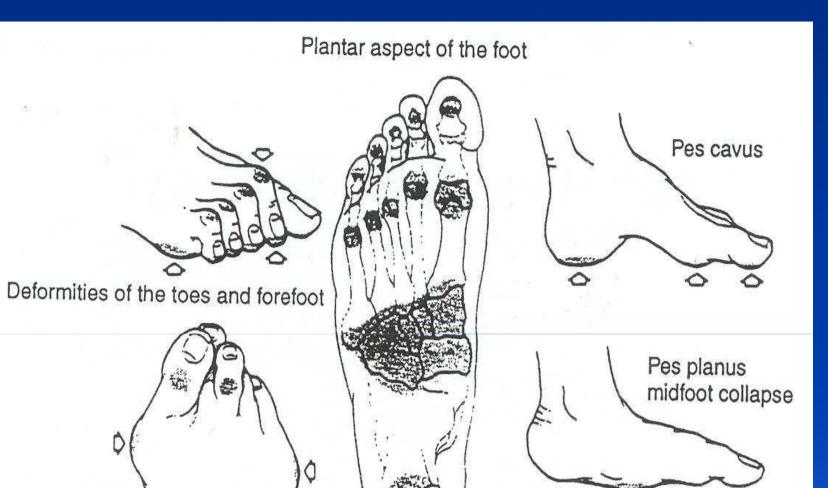
Magnitude of problem



The foot of a diabetic patient that has the potential risk of pathologic consequences including infection, ulceration and or destruction of deep tissues associated with neurologic abnormalities, various degrees of peripheral vascular disease and/or metabolic complications of diabetes in the lower limb

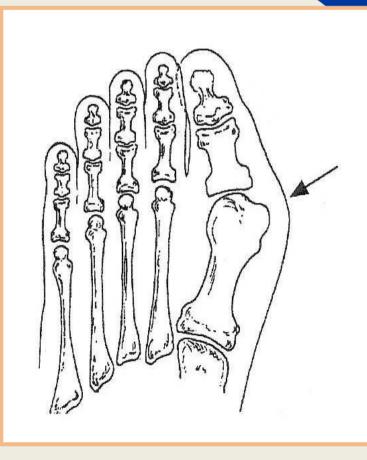
Dia betic foot disease dynamic view

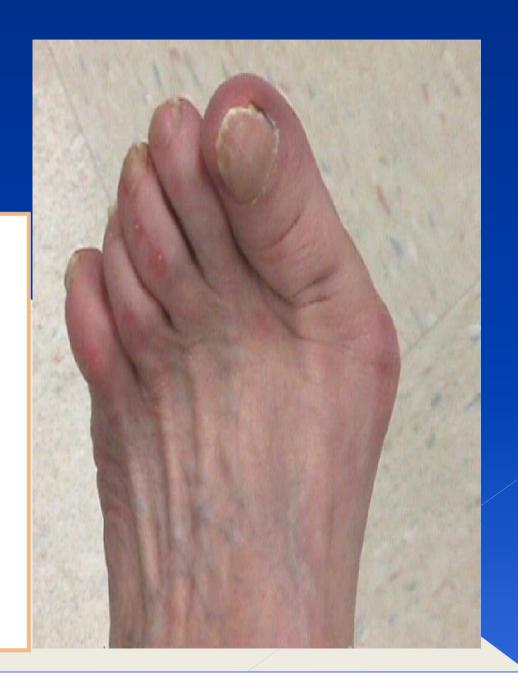
- Ischaemia
- Neuropathy/angiopathy
- Structural deformity /claudication
- Ulcer
- Infection
- Amputation



Shaded areas and arrows indicate primary regions 'at risk' for developing ulcers

Hallux formation





Charcot Foot





Foot examination prevalence

Vascular:

Palpation of pulses
Presence of edema
ABPI (Ankle brachial pressure index)
Doppler segmental pressure and

Laser doppler velocimetry

Neurological:

Pain
Semmes-Weinstein monofilament
test
Babinski test
Romberg test

Dermatological:

Skin/limb color changes
Visual observation of Hallux
valgus. Charcot joints,
Calluses, Fissures,
Ulceration/infection/ gangrene
Waaner's classification

REAL-TIME' ULCER/WOUND DOCUMENTATION

OXYGEN

- saturation
- tension

TEMPERATURE

- far IR imaging
- far IR spectroscopy

COLOUR

- inflammation
- wound status

STRUCTURE

fractal dimension

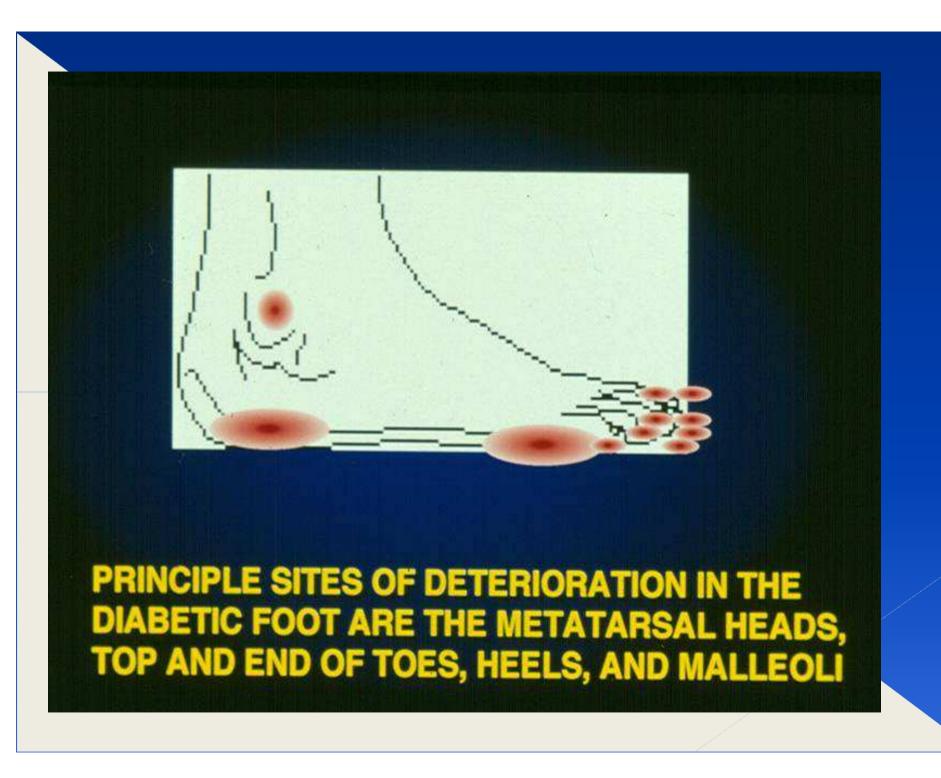
WOUND

BLOOD FLOW

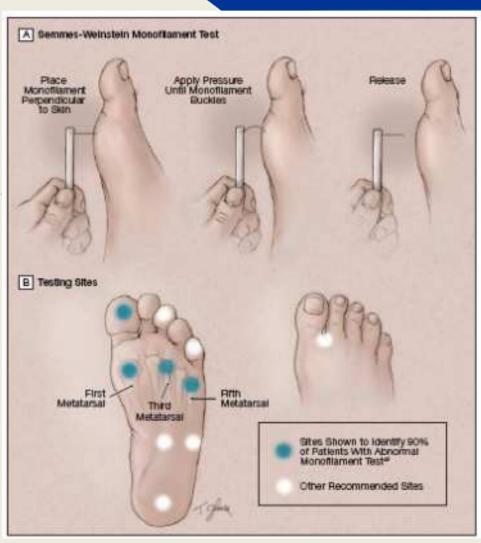
- ultrasound Doppler
- laser Doppler
- plethysmography

SIZE

- area, volume
- limb size



Semmes-Weinstein monofilament test





Foot ulcer

A foot ulcer in a diabetic patient, most probably due to nerve damage



Wagner's Classification

- 0 Intact skin (impending ulcer)
- 1 superficial
- 2 deep to tendon or ligament
- 3 deep abscess, osteomyelitis
- 4 gangrene of toes or forefoot
- 5 gangrene of entire foot

Wagner's stage 0

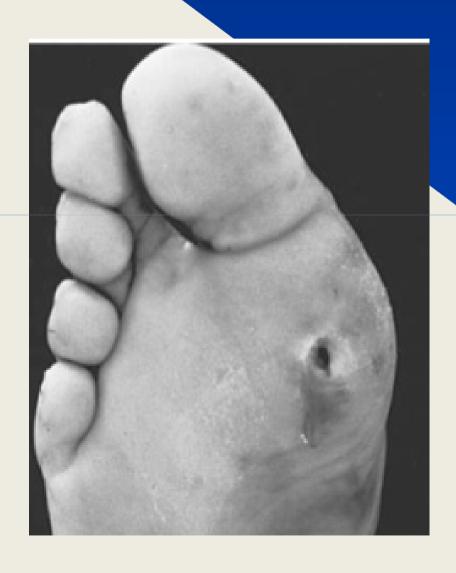


Wagner's stage 1-2





Wagner's stage 3





Wagner's stage 4



Wagner's stage 4-5

Amputation Level ???

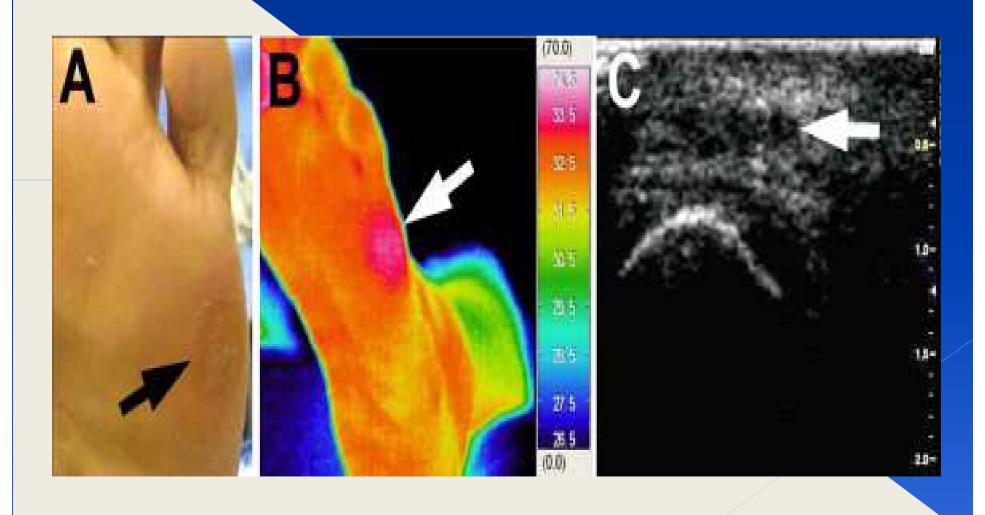




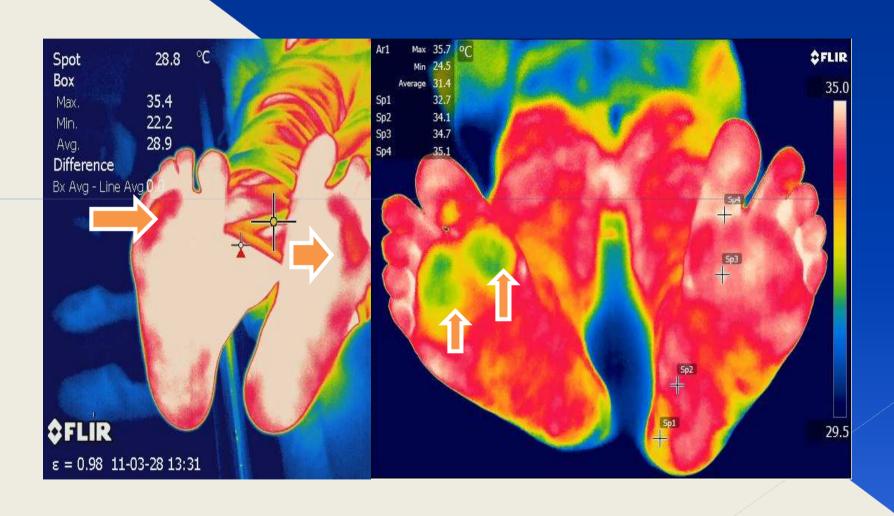
Diabetic foot successfully treated!



Visual-thermagraphy-ultrasound



Foot microangiopathy induced ulcer formation



Foot examination prevalence

Vascular:

Palpation of pulses
Presence of edema
ABPI (Ankle brachial pressure index)
Doppler segmental pressure and waveform analysis

Neurological:

Pain
Semmes-Weinstein monofilament
test
Babinski test
Romberg test

Dermatological:

Skin/limb color changes
Visual observation of Hallux
valgus. Charcot joints,
Calluses, Fissures,
Ulceration/infection/ gangrene
Wagner's classification

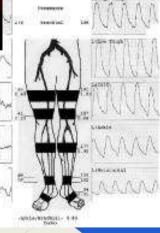
Periphery Arteries Disease

PAD diagnostic

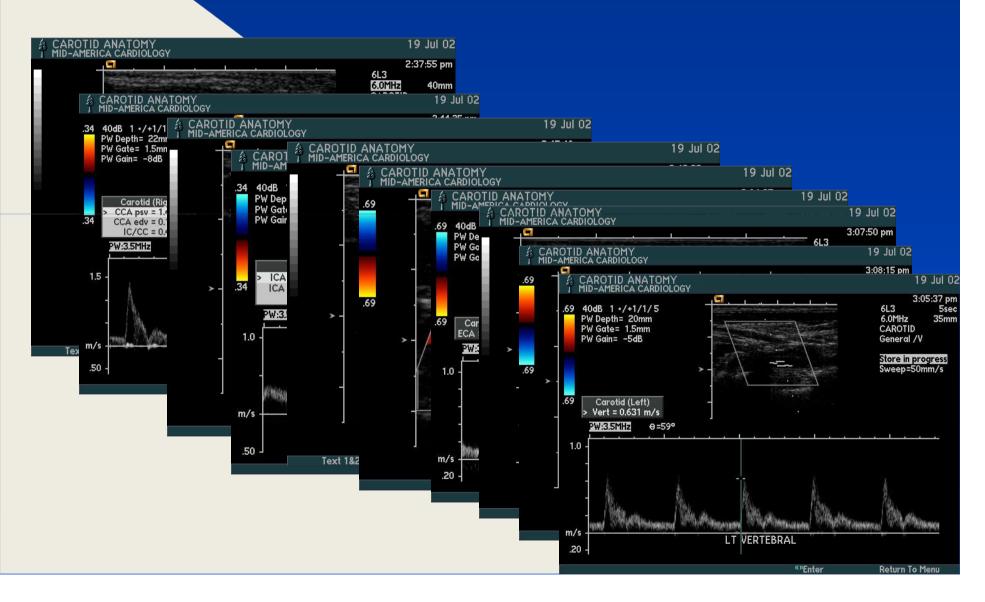
- Physical examination
- O Ankle-brachial index
 - Normally the blood pressure in the ankle is at least 90% of the blood pressure in the arm.
 - Blockage in the legs cause this to be reduced.
- Leg Ultrasound studies
 - > Lower extremity duplex





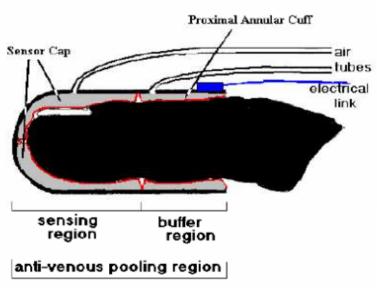


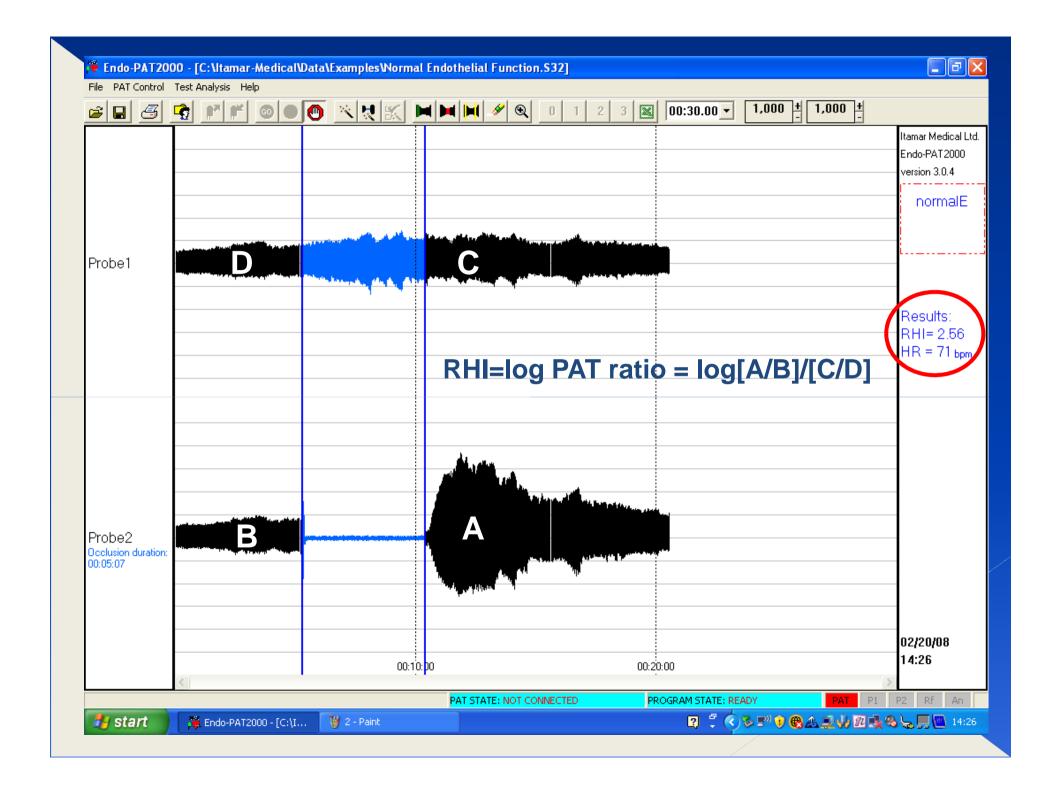
Carotid Duplex investigation



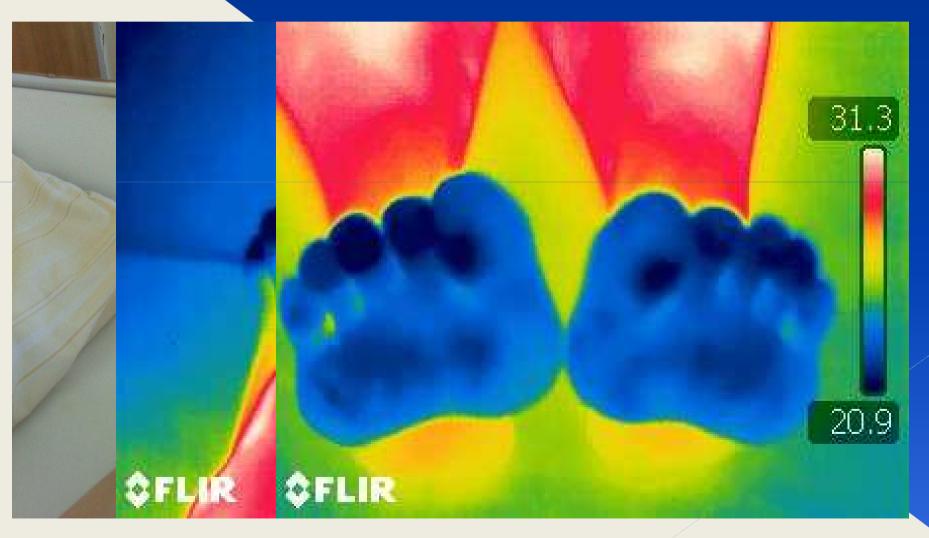
PAD TONOMETRY



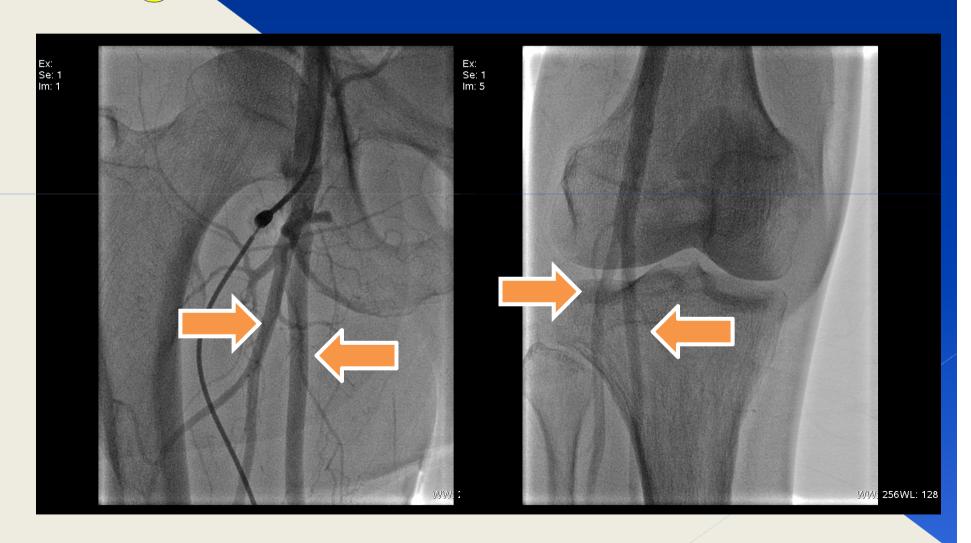




Patient V.P., DM – 15 y., no signs of discomphort, pain, neuropathy and angiopathy, cold foots



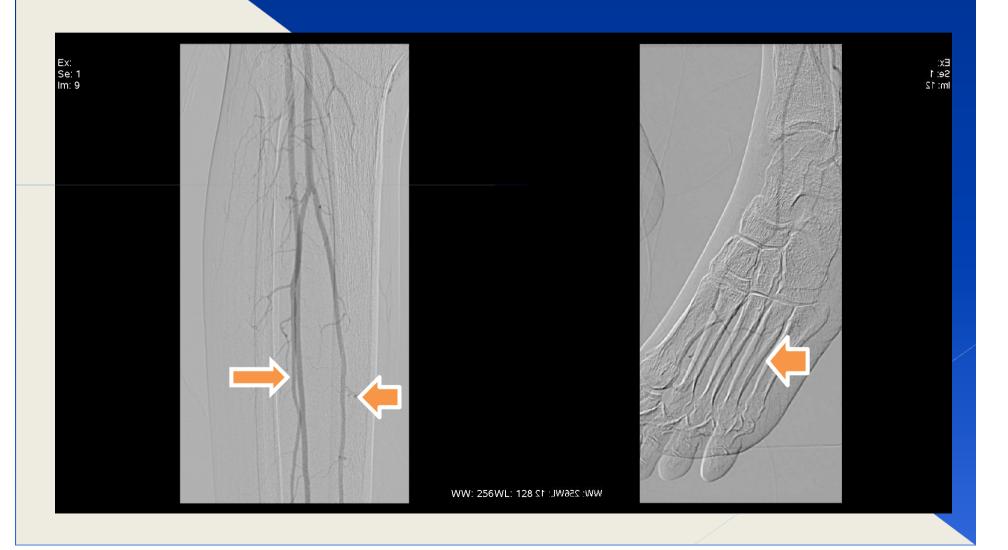
Angiography examination – right foot



Angiography examination – right foot



Angiography examination – left foot



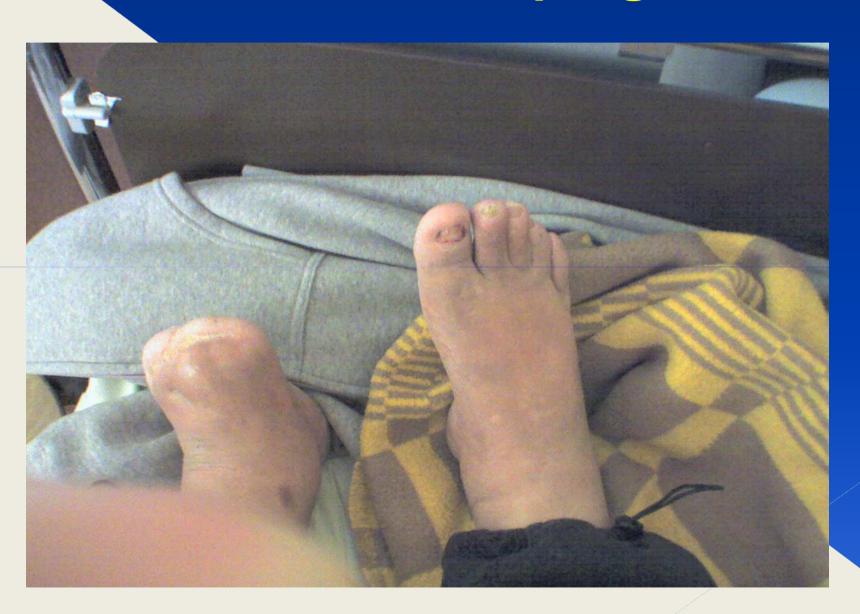
Diabetic foot prognosis



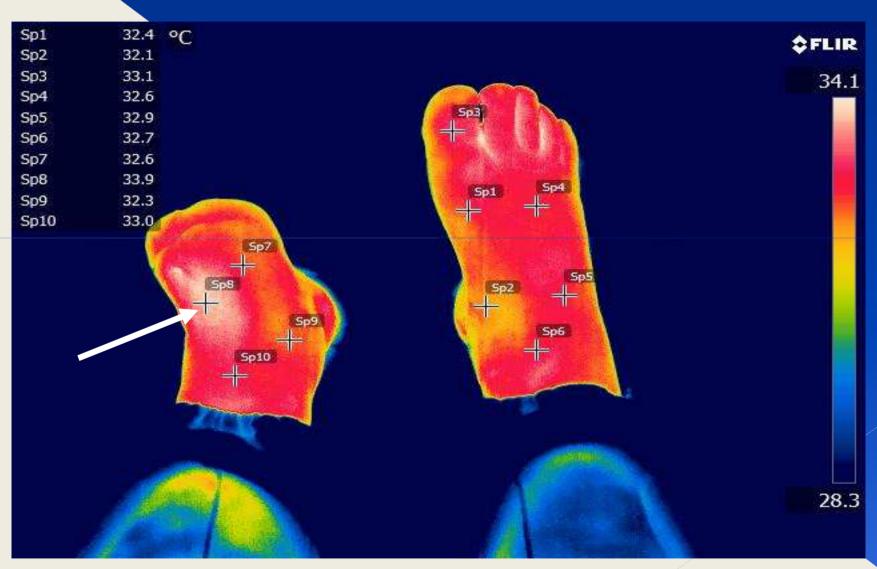
Diabetic foot prognosis



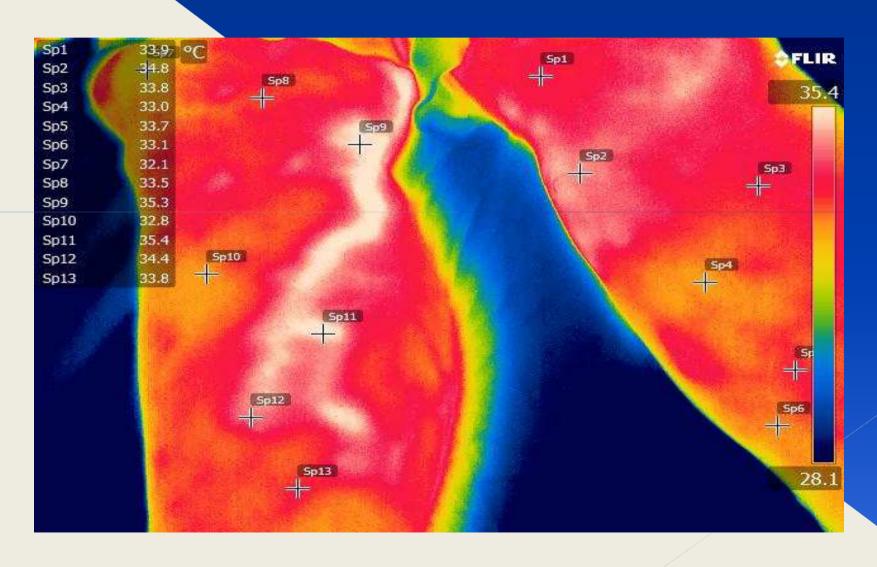
Diabetic foot prognosis



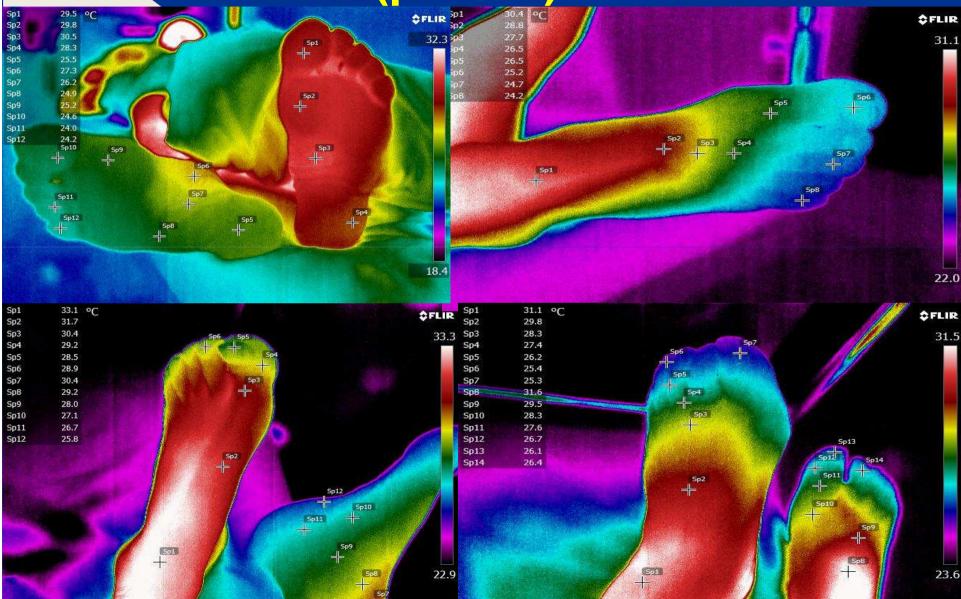
Diabetic foot prognosis osteomielitis



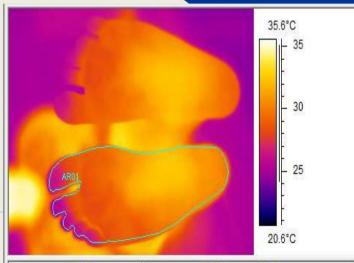
Vein varicose induced thromboflebitis



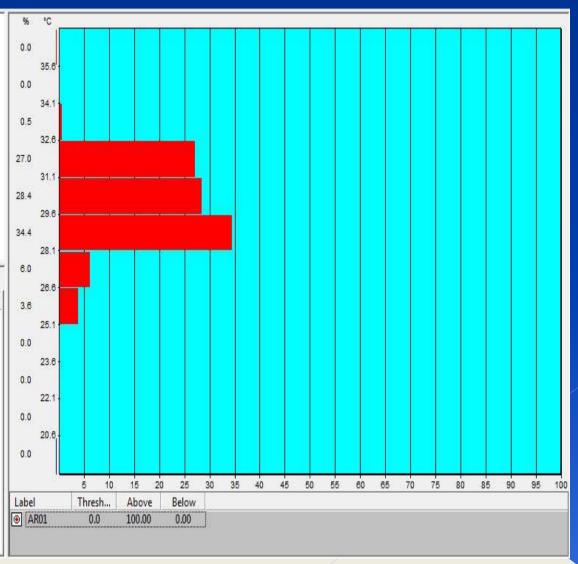
IR thermography diagnostic tools (palette)



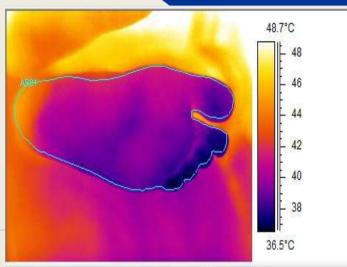
Normal foot



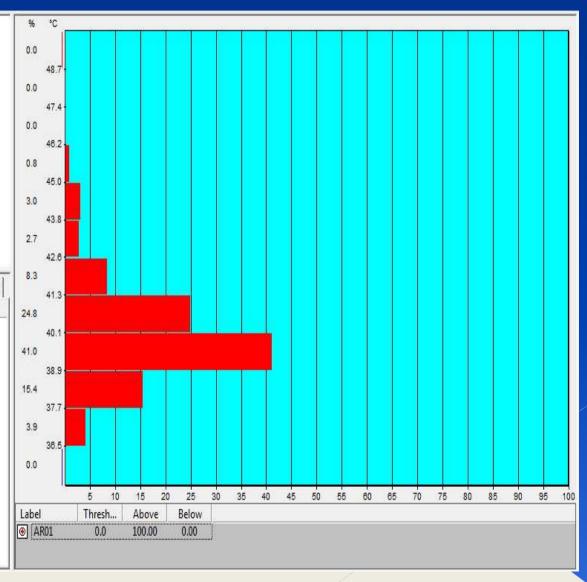
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Label	Pos X1	Pos Y1	Pos X2	Pos Y2	Width	Height
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Bad perfused foot







- The method makes it possible to objectively assess the condition of blood flow to the feet in the subclinical stage
- Methods allow you to safely diagnose circulatory disorders of the feet
- Method makes it possible to objectively and dynamically compare the changes in the blood flow of the feet
- Method take possibility to assess rehabilitation treatment and the effectiveness of pharmacological preparations affecting microcirculation

Thank
you for
attention











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