

DISORDERS DUE TO VIBRATIONS

Vibrations - mechanical energy from oscillating source transmitted to another structure.

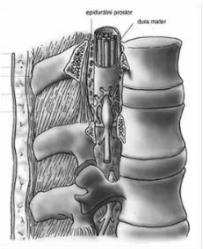
Effect of **whole body vibration**:

fatigue, kinetosis

and injuries of the spine - **spinal degenerative disc disease**. 15 countries in Europe (France, Germany,

But they are not considered as occupational diseases in the Czech Republic.

Criteria are being prepared for low back pain disorders.



DISORDERS DUE TO VIBRATIONS

I. BONES AND JOINTS

II. VESSELS

III. NERVES

no tendinitis, epicondylitis, bursitis

SEGMENTAL VIBRATION OF UPPER EXTREMITIES

– local vibrations to the hands + arms

Exposure to vibration from hands' tools:

power saws,
grinders,
sanders,
pneumatic drills,
jackhammers



Limits of vibrations of the tools **may be exceeded**

Jobs: miners, tunnelers, stonecutters, foundry workers, woodsmen...



I. INJURY OF BONES AND JOINTS INDUCED BY VIBRATION



1) ASEPTIC NECROSIS of carpal and metacarpal bones

Clinical findings: pain, restriction of motion

Diagnosis: X-ray, CT of the joint



2) OSTEOARTHROSIS of the joints of the hands, wrist, elbow

Only **isolated osteoarthritis** (it is a frequent disease) of the exposed joint might reported as an occupational disease

Clinical findings: pain, restriction of motion

Diagnosis: X-ray, CT of the joint (joint space narrowing, subchondral sclerosis and marginal osteophytes)

Treatment: elimination of the harmful activity; anti-inflammatory drugs, surgical arthroplasty or total replacement

CLASSIFICATION OF THE SEVERITY OF ARTHROSIS

| Grade | Kellgren-Lawrence Scale (1957) |
|-------------|---|
| 0 | No osteophytes |
| 1 | Doubtful osteophytes |
| 2 MILD | Minimal osteophytes, possible narrowing, cysts, and sclerosis |
| 3 MEDIUM | OSTEOPHYTES and moderate JOINT SPACE NARROWING |
| 4 SEVERE | LARGE OSTEOPHYTES and DEFINITE JOINT SPACE NARROWING |

II. Disease of the vessels WHITE FINGERS DISEASE INDUCED BY VIBRATION

A) VASOSPASTIC STAGE - Raynaud's phenomenon

Attacks of vasospasm lasting several minutes (15 - 60) provoked by cold.

Clinical findings: tingling, numbness, whitening.

Return of blood circulation following redness, swelling, acute pain and paresthesias.

b) VASOPARALYTIC STAGE – cyanosis – more severe
- BUT NEVER NECROSIS!!!

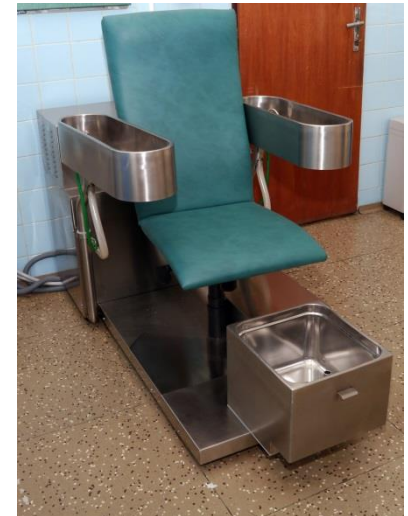
Diagnosis

Cold water provocation test – hands and forearms 10°C for 10 min

Finger plethysmography before and after cold water provocation test

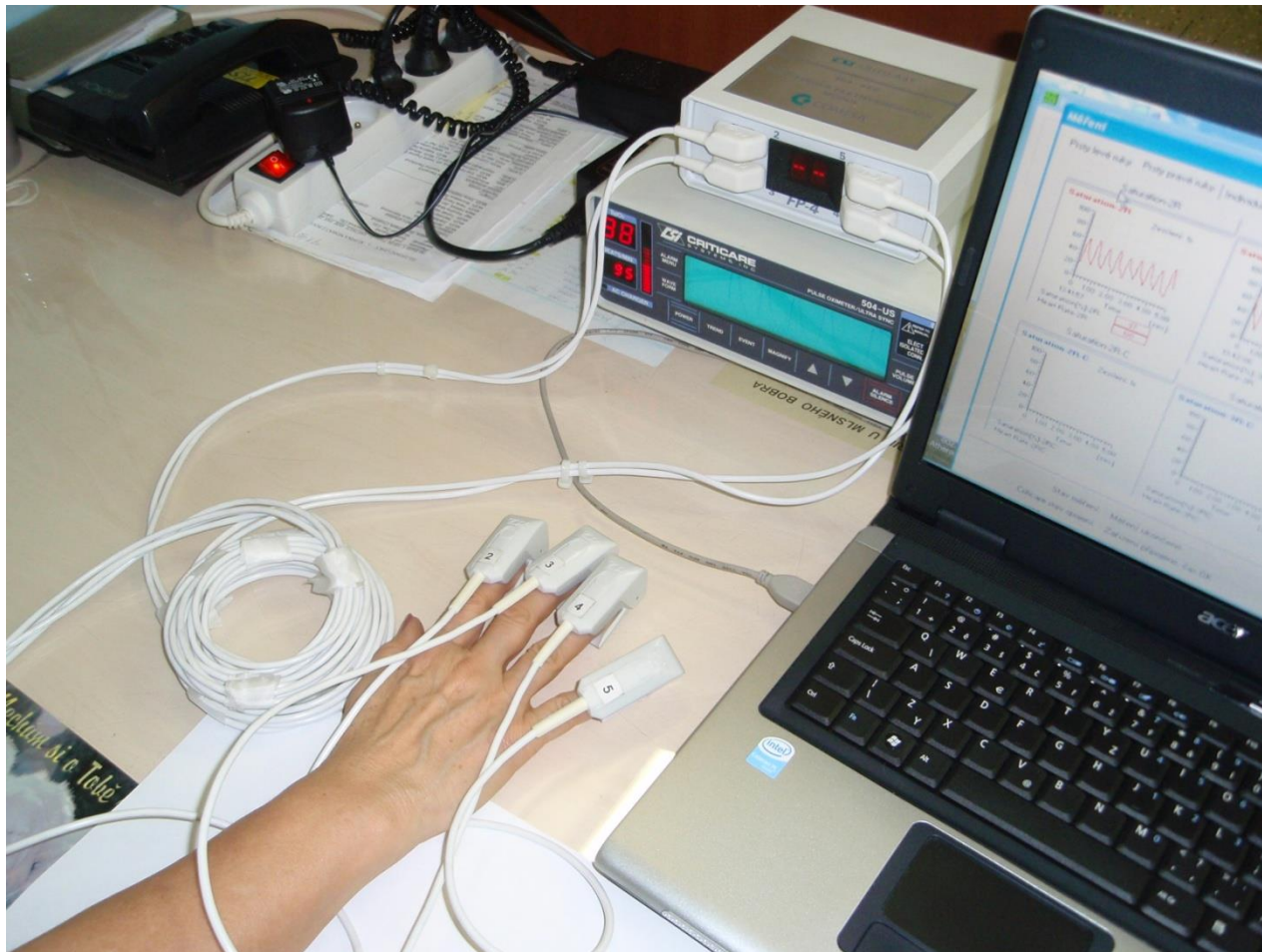
Lewis-Prusík test – pressure on last phalanx and measuring time to restore normal color (normal less than 10 sec)

BENIGN.Treatment usually not needed - reversible after removed of the worker from vibration exposure, vasodilators (pentoxifylline). Good prognosis.



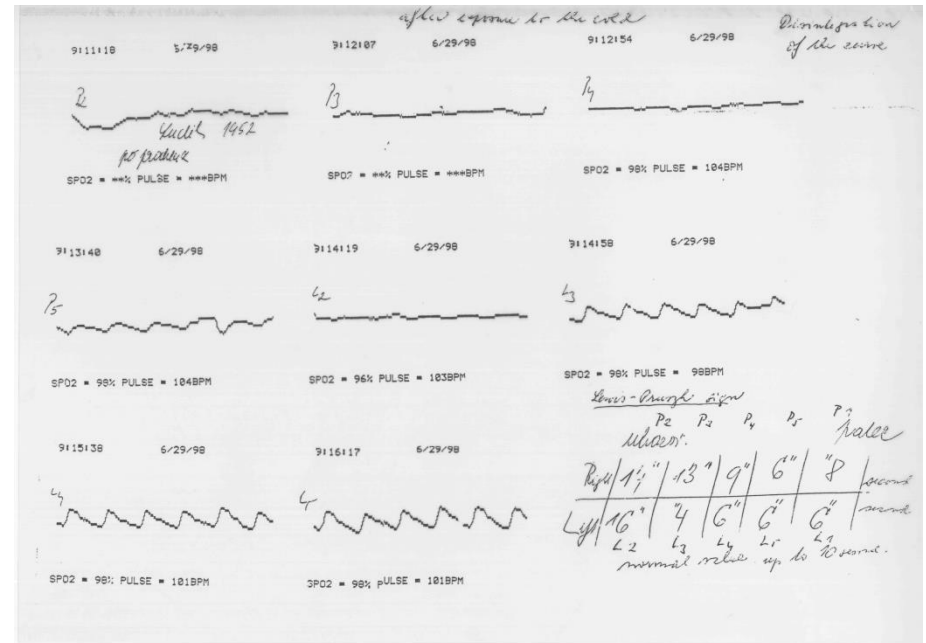
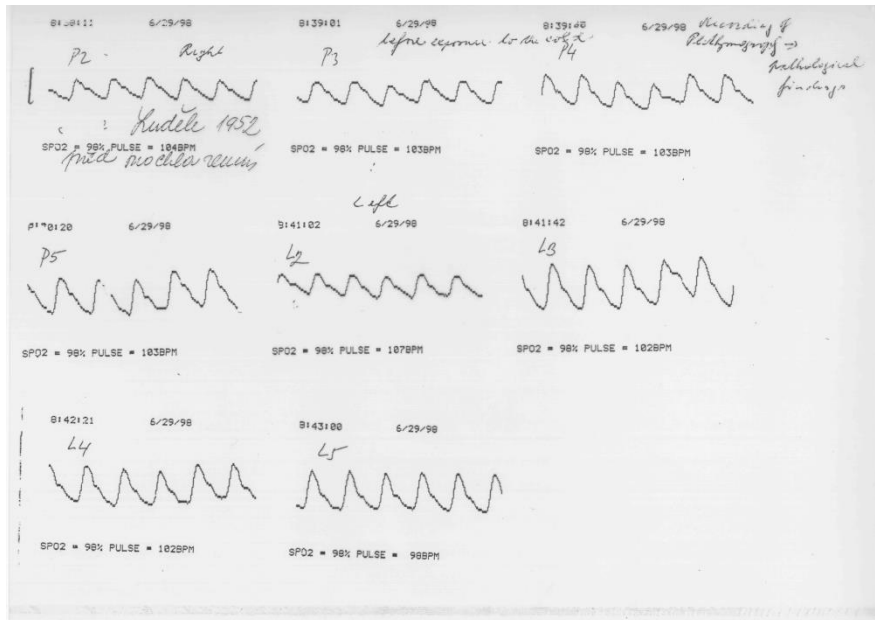
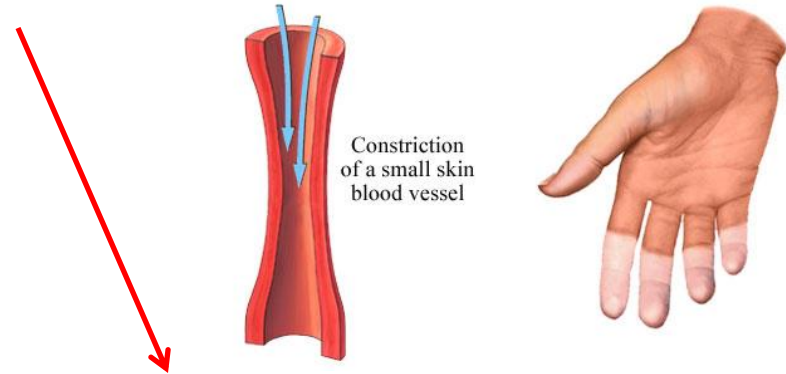
Finger photoplethysmograph - pulse oximeter

(shows pulse in the distal phalanges)

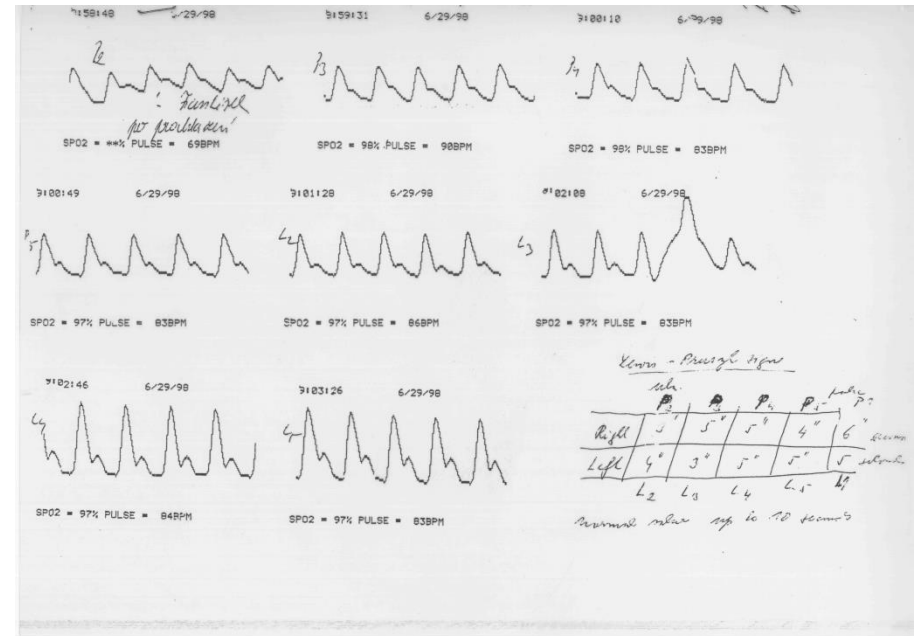
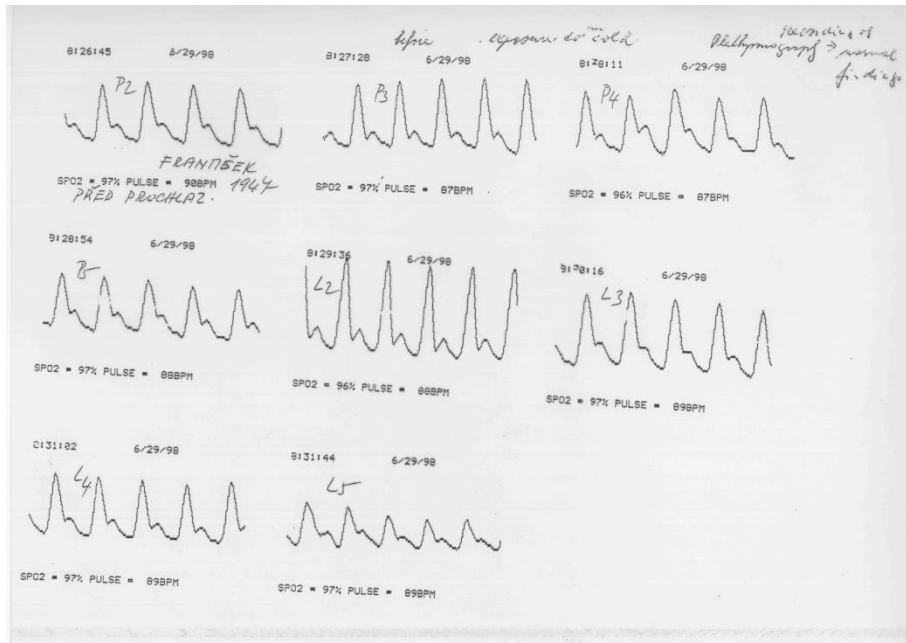
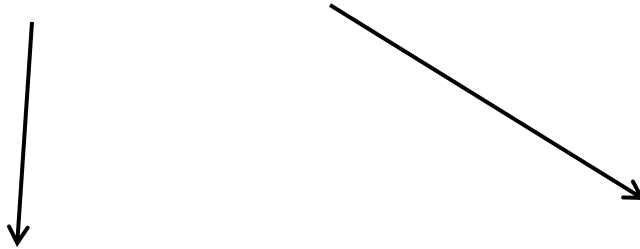


Pathological finger plethysmography after cold water provocation test flattening of the curve

flattening
of the curve



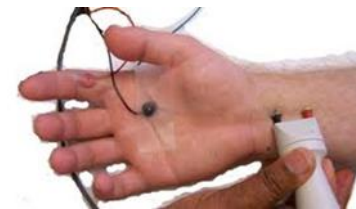
Normal finger plethysmography before and after cold water provocation test



III. PERIPHERAL NEUROPATHY INDUCED BY VIBRATION

**Direct influence of vibrations
and repeatedly impaired nutrition of the nerve
due to vasospasm
frequently both ulnar and median nerve are affected**

**Diagnosis by EMG – electromyography – SLOWER
CONDUCTION VELOCITY**

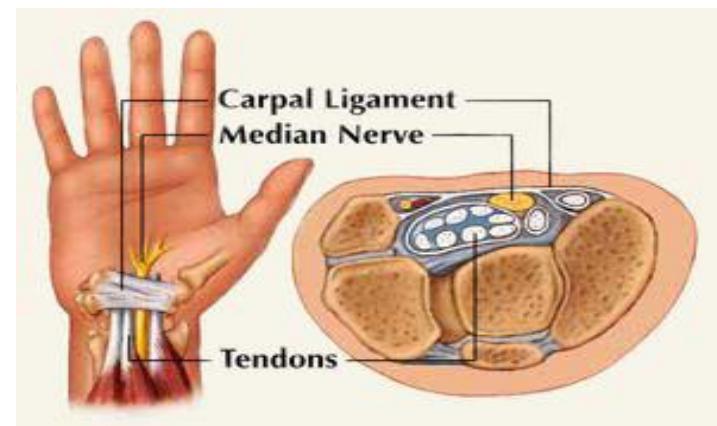
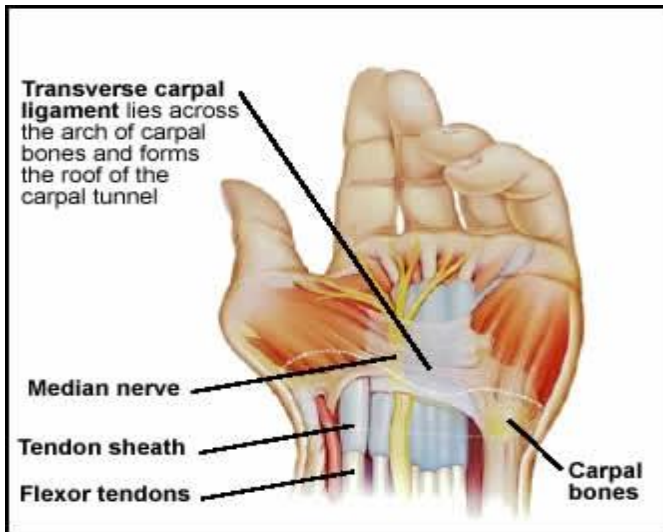


CARPAL TUNNEL SYNDROME

chronic traumatic or pressure or ischemic neuropathy

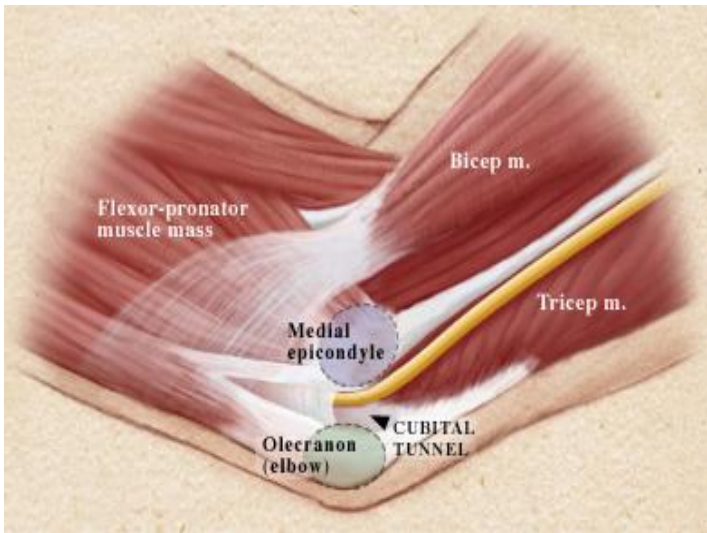
of the median nerve as it passes through the carpal tunnel volar to 9 flexor tendons

Symptoms: pain and paresthesias in the median nerve distribution, thenar atrophy



CUBITAL TUNNEL SYNDROME - ulnar nerve, which passes through the **cubital tunnel** (a tunnel of muscle, ligament, and bone) on the ulnar side of the elbow, becomes irritated due to chronic injury or pressure.

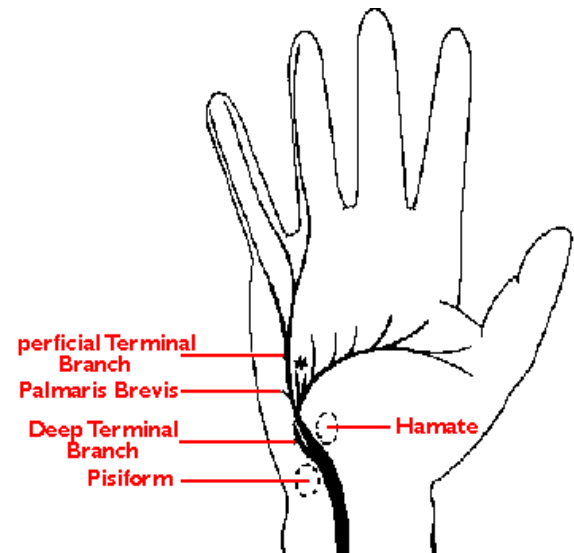
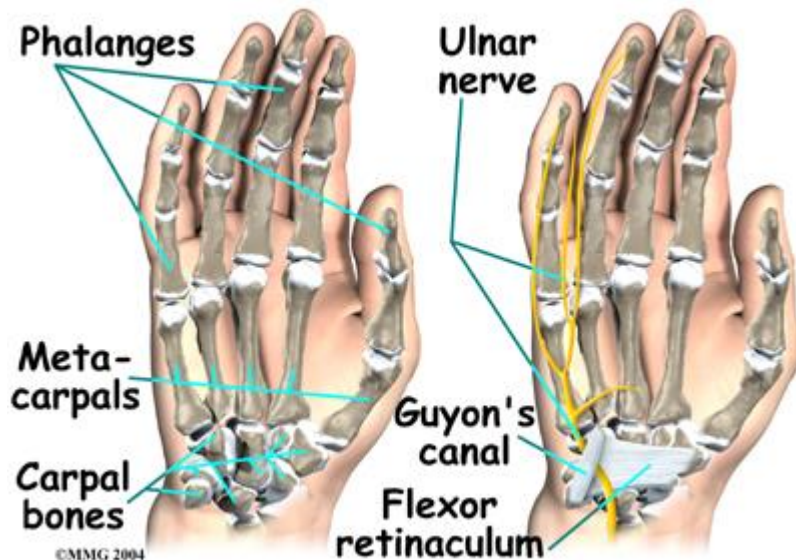
Symptoms: pain and paresthesias in the ulnar nerve distribution (into the 4th and 5th fingers)



GUYON'S CANAL SYNDROME

compression of the ulnar nerve within the palm of the hand.

Tunnel is formed by two bones (the *pisiform* and *hamate*) and the ligament that connects them.



DIAGNOSIS of vibrations induced disorders:



Symptoms on preventive examinations - neurological examination and EMG – earlier injury of sensory fibres (DYSESTHESIAS), later injury of motor fibres (MOTORIC PROBLEMS)

Treatment: removing from vibration exposure, vasoactive and anti-inflammatory drugs, injections of steroids into the tunnel, surgical tunnel release

Prevention: **correctly designed tools**, gloves to minimize vibration and keep the hands warm, instruction of the workers about the early symptoms.

DISEASES DUE TO OVERLOAD OF THE UPPER AND LOWER EXTREMITIES

- I. MUSCULOSKELETAL INJURIES – TENDINITIS,
EPICONDYLITIS, BURSITIS**
- II. JOINTS – ARTHROSIS**
- III. NERVES – NEUROPATHY**

no vessel damage

DISEASES DUE TO OVERLOAD OF THE UPPER AND LOWER EXTREMITIES

I. MUSCULOSKELETAL INJURIES

- most frequent occupational diseases, in males and females after the age 40.



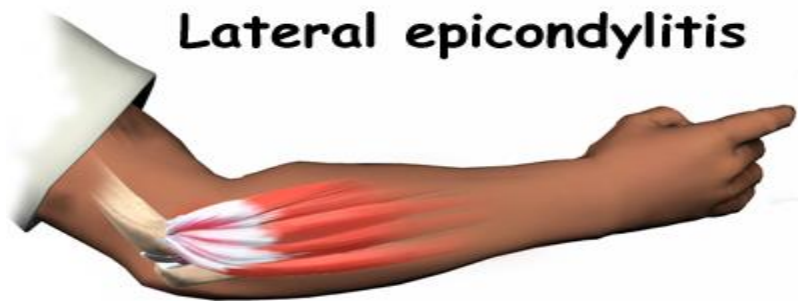
A cumulative trauma, most often occurs after a long work history of exposure, 15-30 years at least .

Causative factors is REPEATED MECHANICAL STRESS –

- 1) long lasting – not injury mechanism (not one shift)
- 2) repeated - thousands of motions a shift.....
- 3) Extreme strain more then 10% F_{max} for static work (holding objects) and more then 30% F_{max} for dynamic work of the musculoskeletal system MUST BE PROVEN by measurements at the workplace.

HUMERAL EPICONDYLITIS

TENNIS ELBOW AND GOLF (JAVELIN) ELBOW



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Hand repeated
extension

Medial epicondylitis



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Hand repeated
flexion

HUMERAL EPICONDYLITIS

The lesions occur after repeated **FORCEFUL WRIST EXTENSION OR FLEXION**

Clinical findings: local pain, with muscular contraction is pain radiating into the dorsal part of the forearm

Diagnosis: X- ray, 3-phase scintigraphy of the elbow

Therapy:

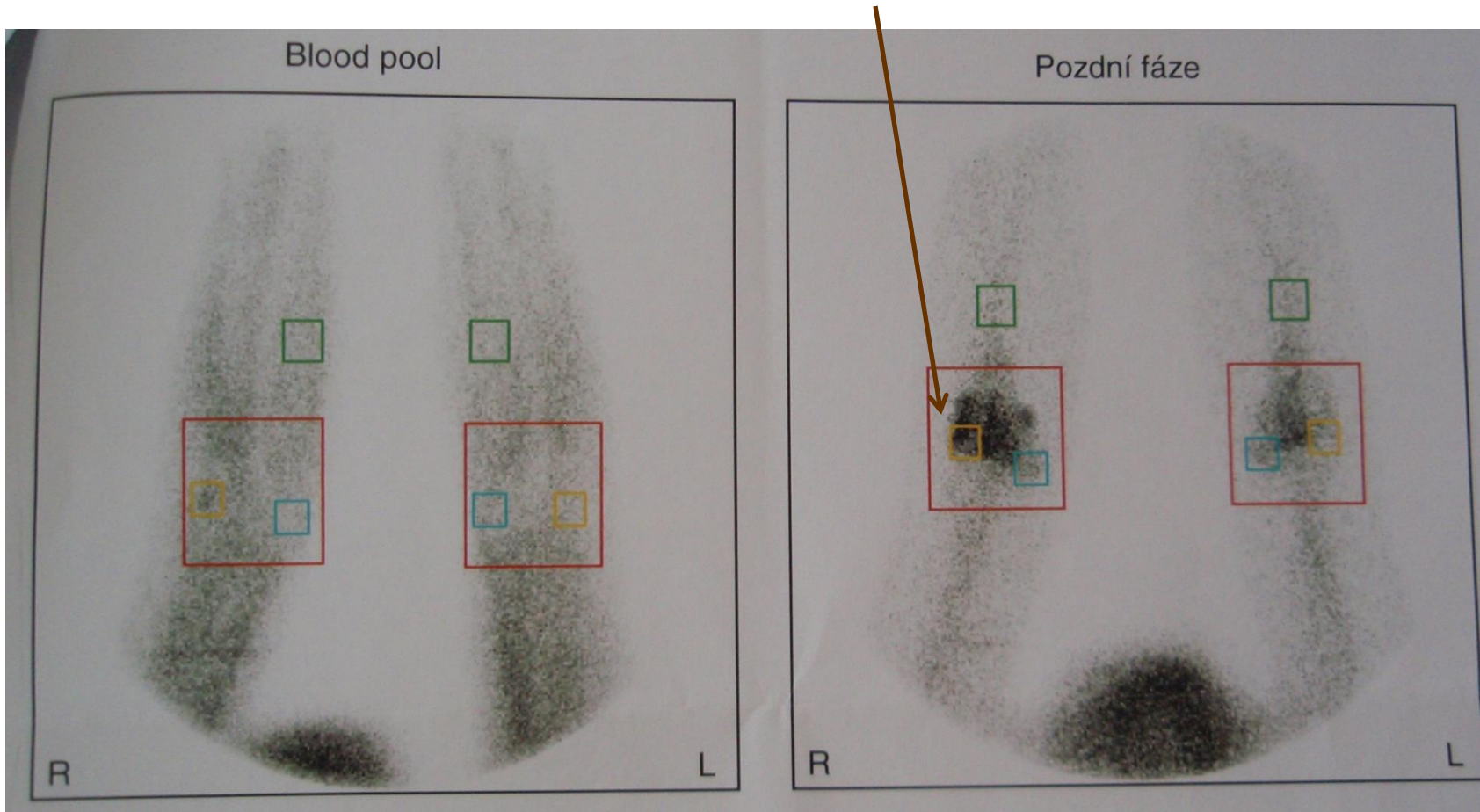
elimination of the harmful activity, immobilization, nonsteroidal anti-inflammatory drugs, corticosteroids injection into the tendon or surgical treatment (*Epicondylitis radialis - excision of the degenerative tissue from common extensor origin, decortication and decompression of lateral epicondyle*).

3 - phase scintigraphy of the elbow

⁹⁹Tc arterial, venous and bone-fibrous phase -
increased activity in the 3rd = late=bone phase

Arterial phase

Bone phase (radial epicondylitis.)



TENDINITIS AND TENDOSYNOVITIS

Aseptic INFLAMMATION of a tendon or of the tendon sheath.

The onset of symptoms - usually associated with OVERUSE of the tendon and often coincides with the beginning of new, repetitive - motion work activities.

Clinical findings and diagnosis: pain, local swelling, crepitus over the tendon sheath.

No specific laboratory or X- ray findings.

Treatment: immobilization,
corticosteroids injection into the tendon,
surgical decompression of the tendon sheath

Trigger finger – „JUMPING FINGER“

the cause of tendosynovitis is repetitive finger flexion.



Morbus de Quervain

TENDOVAGINITIS STENOSANS is a hand disease that causes pain, inflammation and swelling on the outside of the thumb joint.

Crepitation on palpation of the tendons.

No X-ray proof.



02/07
EW

BURSITIS

Aseptic inflammation of a bursa

e.g. **prepatellar** or **olecranon** bursitis is caused **by LOCAL PRESSURE** - in pavers, miners...

Clinical findings: localized fluctuant swelling and pain

Treatment:
immobilization,
diagnostic aspiration,
local corticosteroids
and anti inflammatory injection
or surgical drainage or extirpation



II. OSTEOARTHROSIS DUE TO OVERLOAD OF UPPER EXTREMITIES (RARELY LOWER EXTREMITIES)

Causative factor is repeated mechanical stress and overuse of the joint
ELBOW, SHOULDER, HAND – welders, workers,...
KNEE –paver, miner).

Therapy: elimination of the harmful activity, anti-inflammatory drugs, arthroplasty or total replacement

Arthrosis of the elbow



Omarthrosis



Arthrosis of the knee



Normal findings

III) DISEASES OF THE NERVES

- PERIPHERAL NEUROPATHIES DUE TO OVERLOAD

Carpal tunnel syndrome

Cubital tunnel syndrome

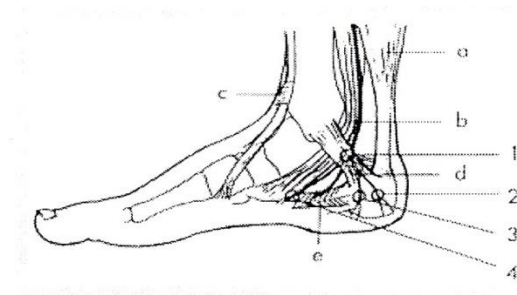
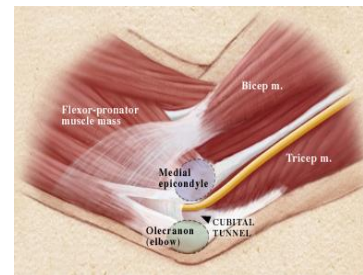
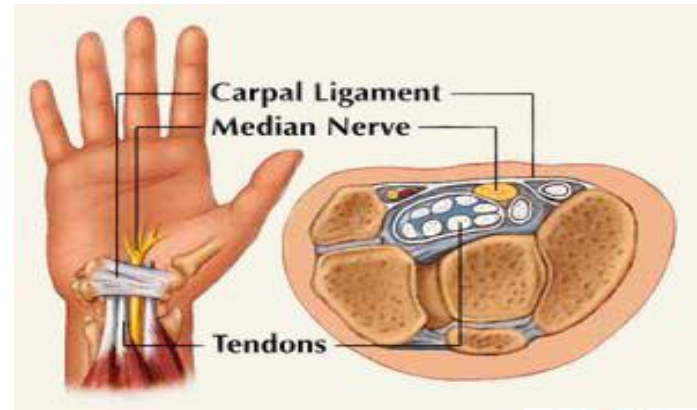
Guyon's canal syndrome

Tarsal tunnel syndrome...

classical ballet dancers

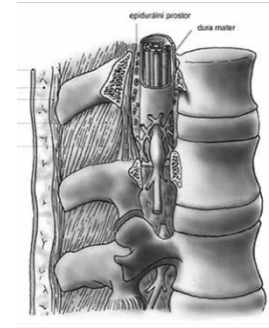
**Clinical finding, diagnosis
and therapy are the same
as in syndromes due to vibrations.**

**Elimination of the harmful activity
is needed, symptomatic or surgical
treatment.**



DISORDERS OF THE SPINE

- LumboSacral



- in 13 European countries (Germany, France, Netherlands, Slovakia, Sweden, Romania,)
- Not acknowledge/not compensated: in the Czech Republic, Bosnia and Herzegovina, Croatia, Finland, Great Britain, Ireland, Norway, Poland and Spain
- Cervical (Germany,..)