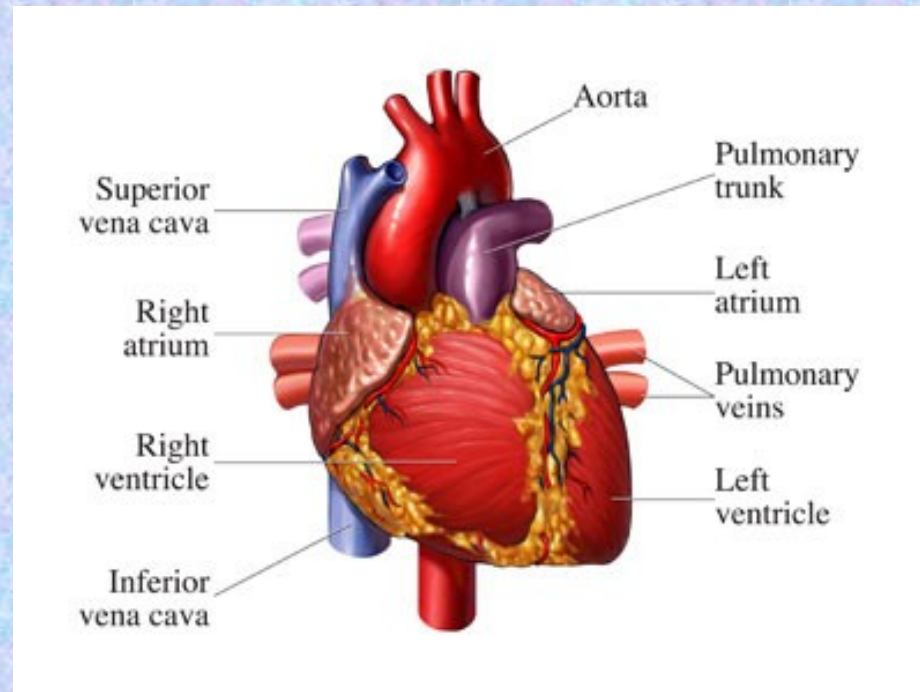


EXAMINATION TECHNIQUES

IN CARDIOLOGY



- **Non-invasive methods**



- **Invasive methods**

- (by puncture needle or catheter)



NON – INVASIVE METHODS

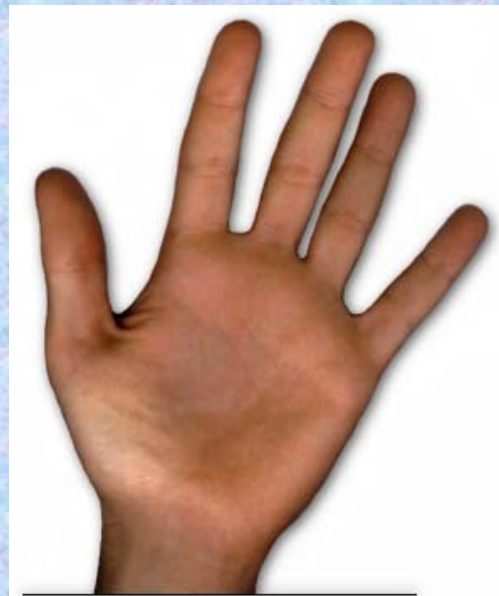
Basic – used together with examination of patients



Inspection



Percussion

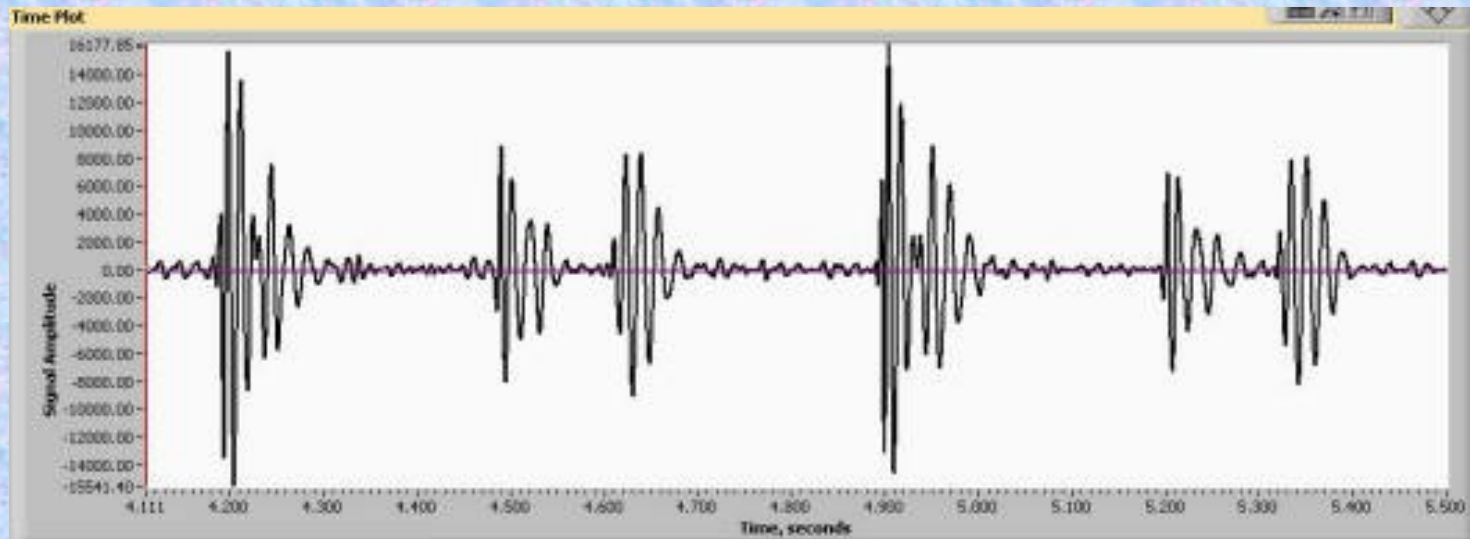


Palpation



Auscultation

- **PHONOCARDIOGRAPHY**



S1

S2

S3

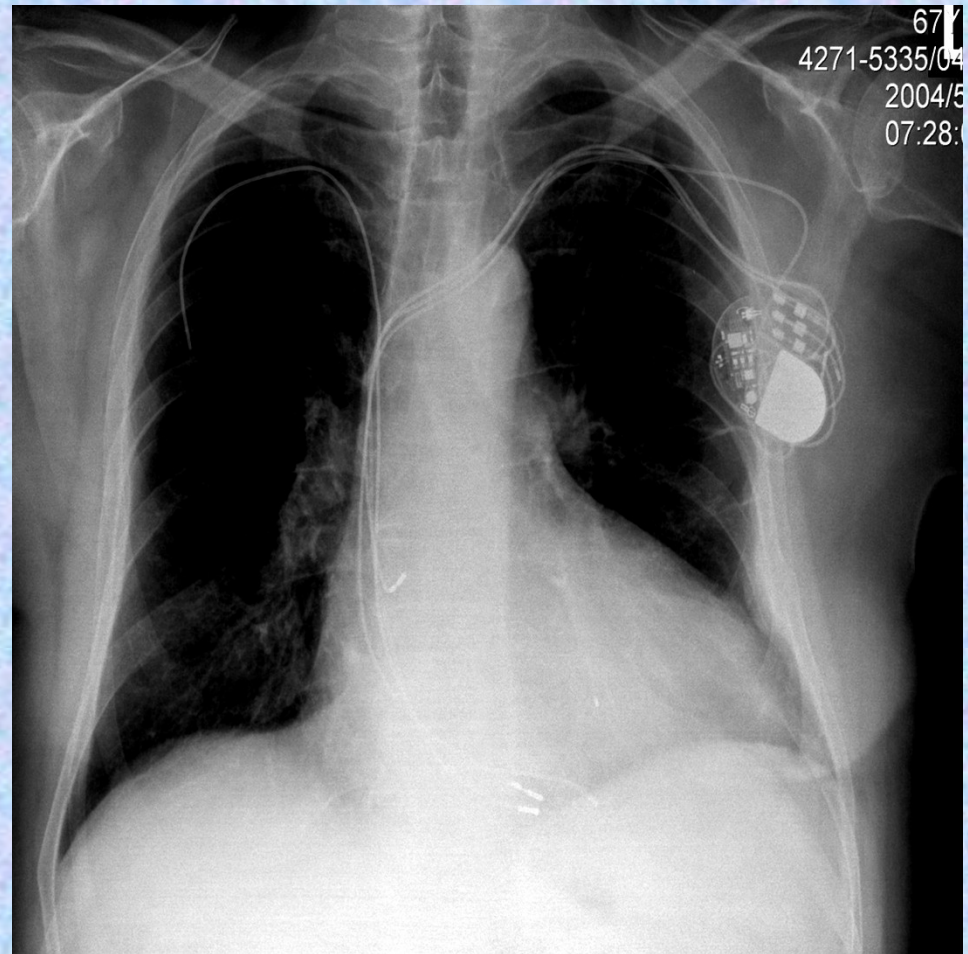
S1

S2

S3

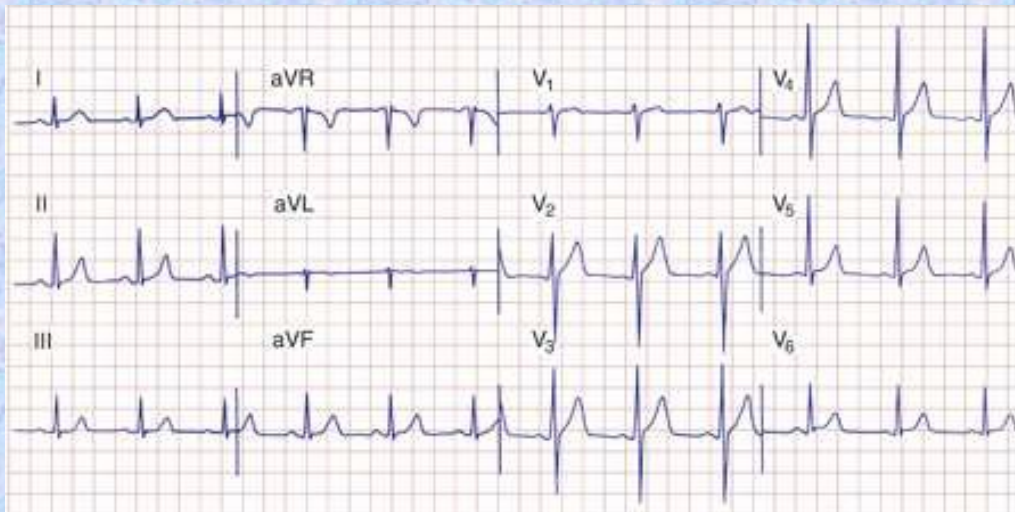
X-ray

Chest x-ray provides useful information about cardiac size and shape, as well as the state of the pulmonary vasculature, and may identify noncardiac causes of the patient's symptoms



ELECTROCARDIOGRAPHY

- A routine 12-lead ECG
- The major importance of the ECG is to assess cardiac rhythm and determine the presence of left ventricle hypertrophy or prior myocardial infarction or QRS width
- Normal ECG excludes left ventricle dysfunction

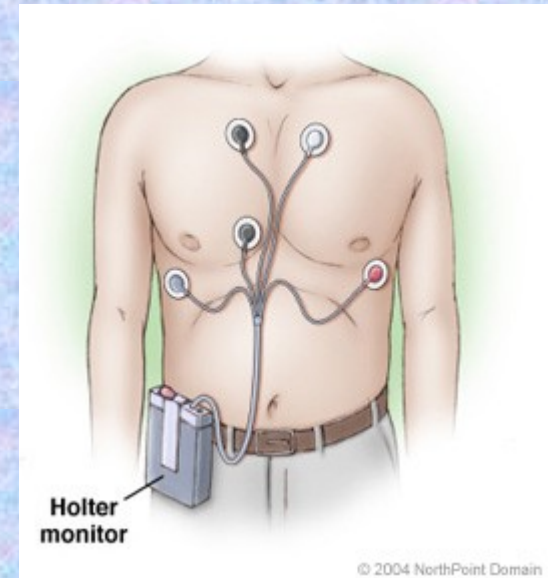


Source: Longo DL, Fauci AS, Kasper DL, Hauser SL, Jameson JL, Loscalzo J: *Harrison's Principles of Internal Medicine, 18th Edition*: www.accessmedicine.com

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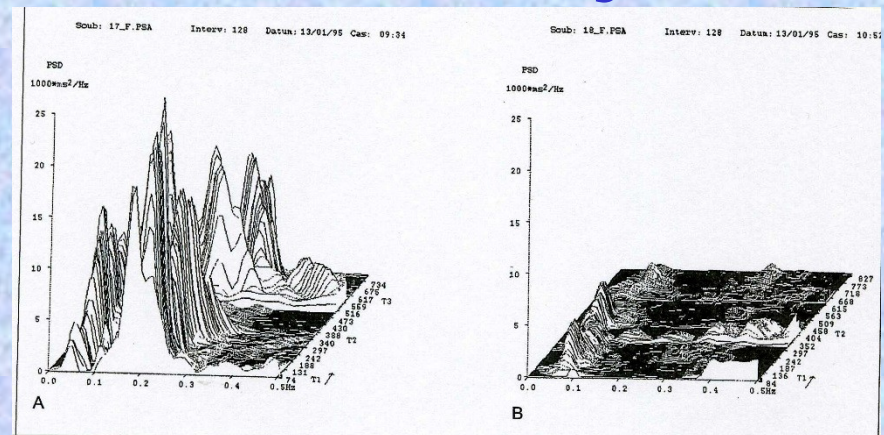
ELECTROCARDIOGRAPHY

- **HOLTER MONITORING**
- 24-hour ECG record



✓ *estimation of heart rate variability*

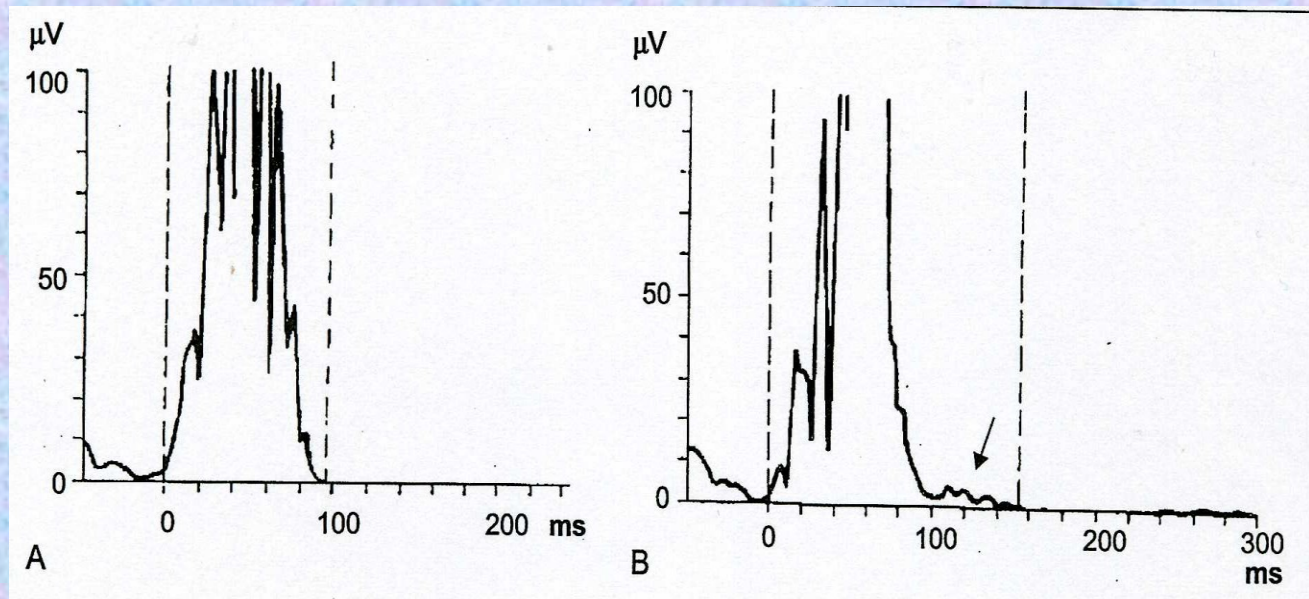
- time analysis
- spectral analysis



ELECTROCARDIOGRAPY

- **HOLTER MONITORING**

✓ *late potentials*



Reveal - implantable recorder

**Patient Activator and
Reveal® Plus ILR**



**Medtronic CareLink®
Programmer**



- small device, without electrodes
- recorder of ECG during syncope
 - activation by patients
 - or autoactivation
- continuously monitoring 36 month, 42 min episodes at memory
- simple implantation, simple evaluation.

BLOOD PRESSURE MEASUREMENT



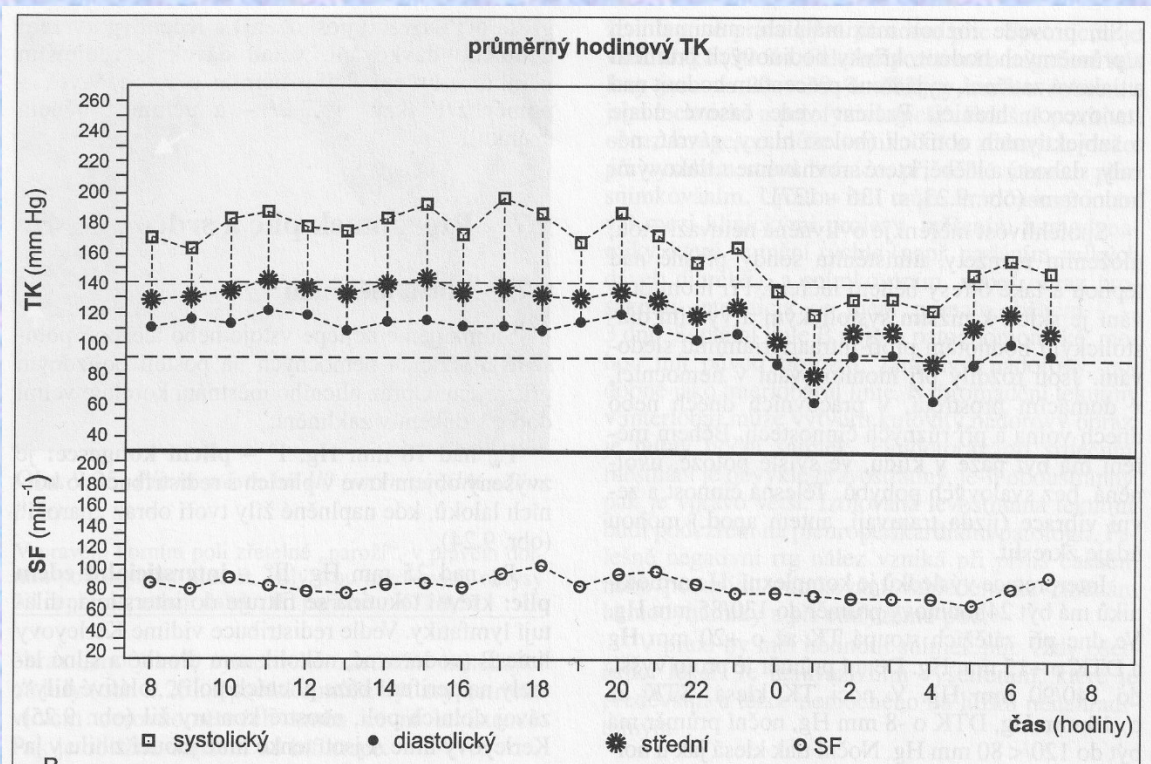
AUSCULTATORY METHOD

OSCILOMETRIC METHOD



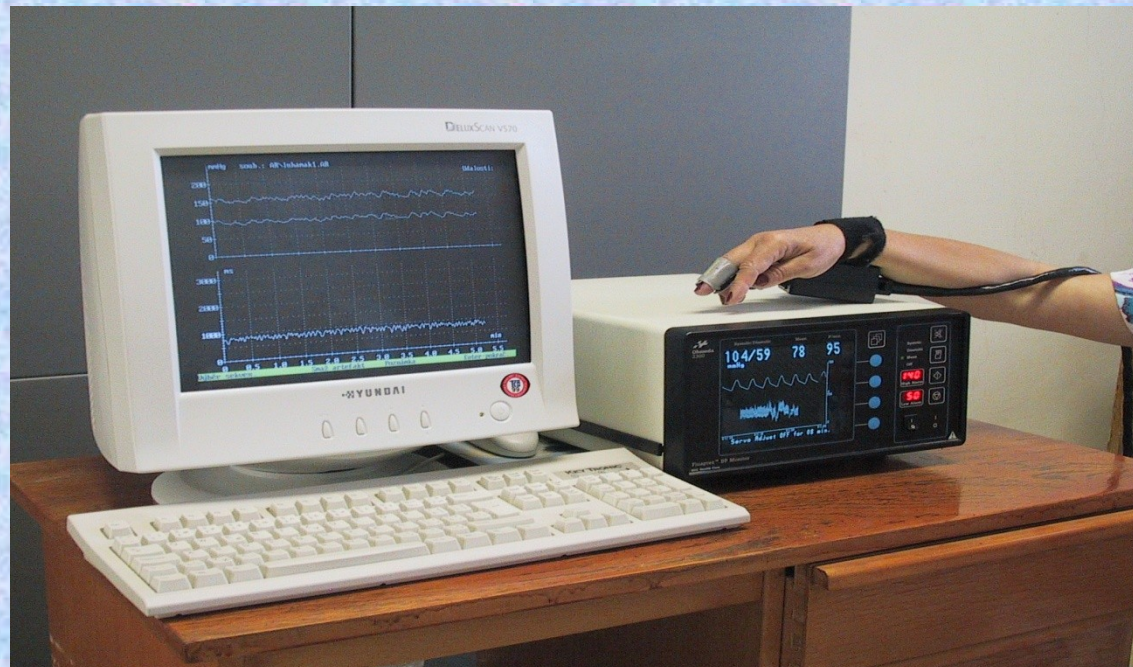
BLOOD PRESSURE MEASUREMENT

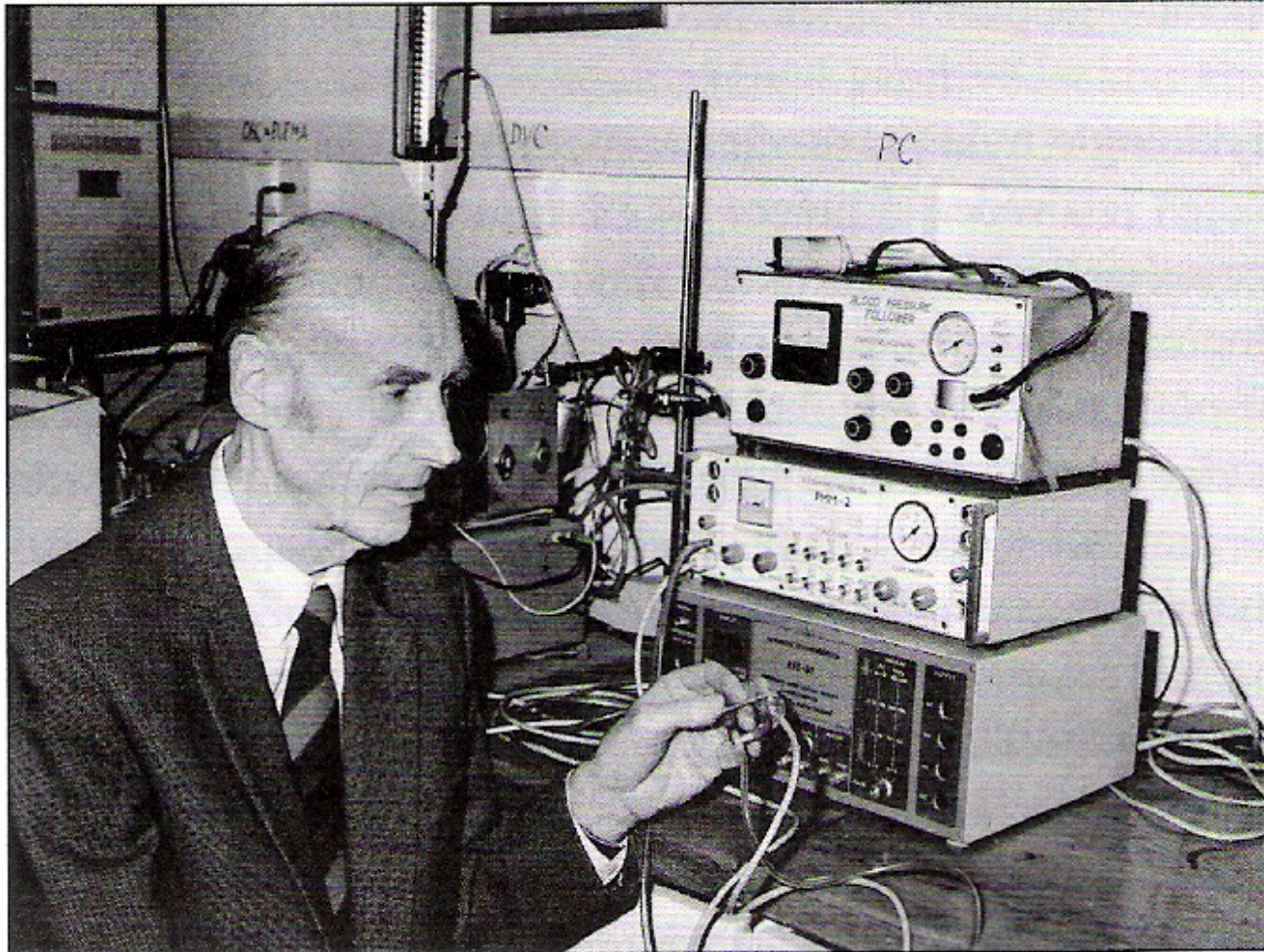
- **AMBULATORY BLOOD PRESSURE MONITORING - ABPM**

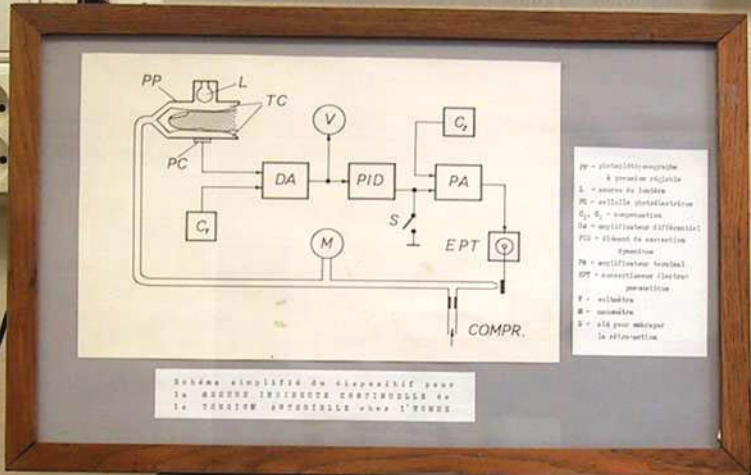


BLOOD PRESSURE MEASUREMENT

- continuously beat-to-beat measurement
- Peñáz principle - photoplethysmography

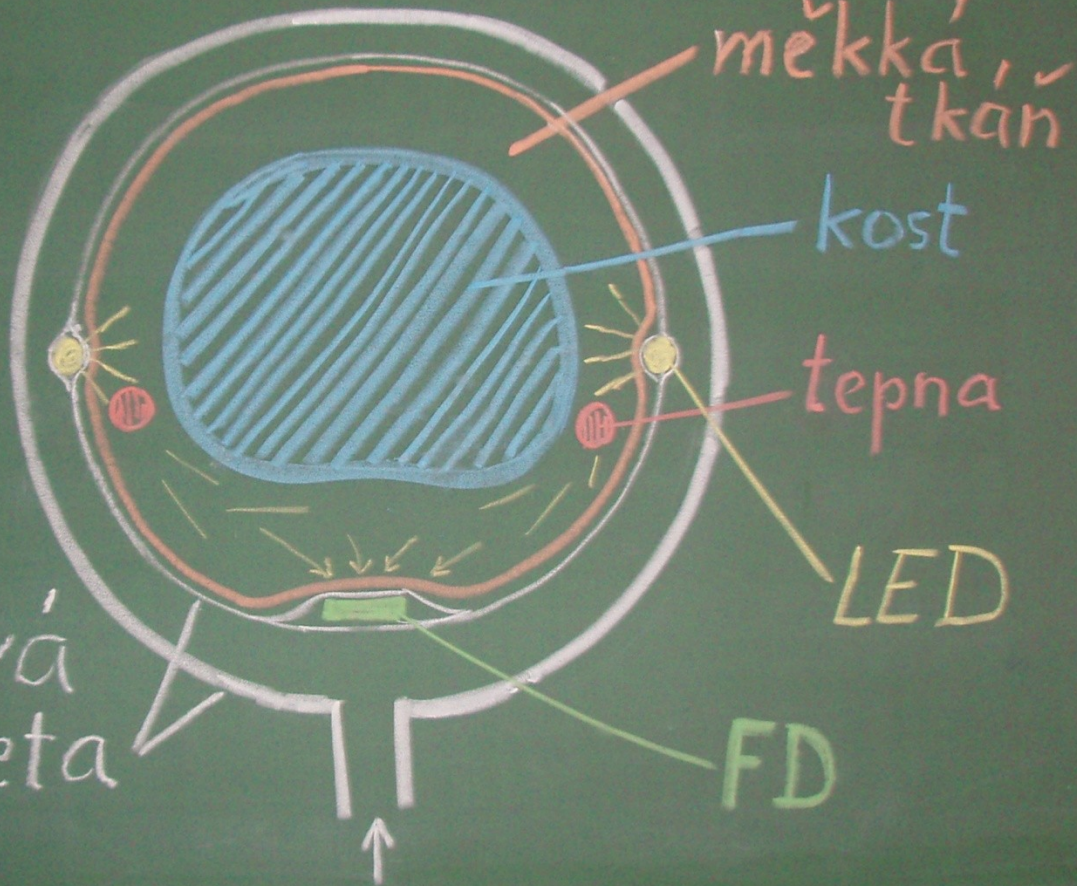








tlaková
manžeta



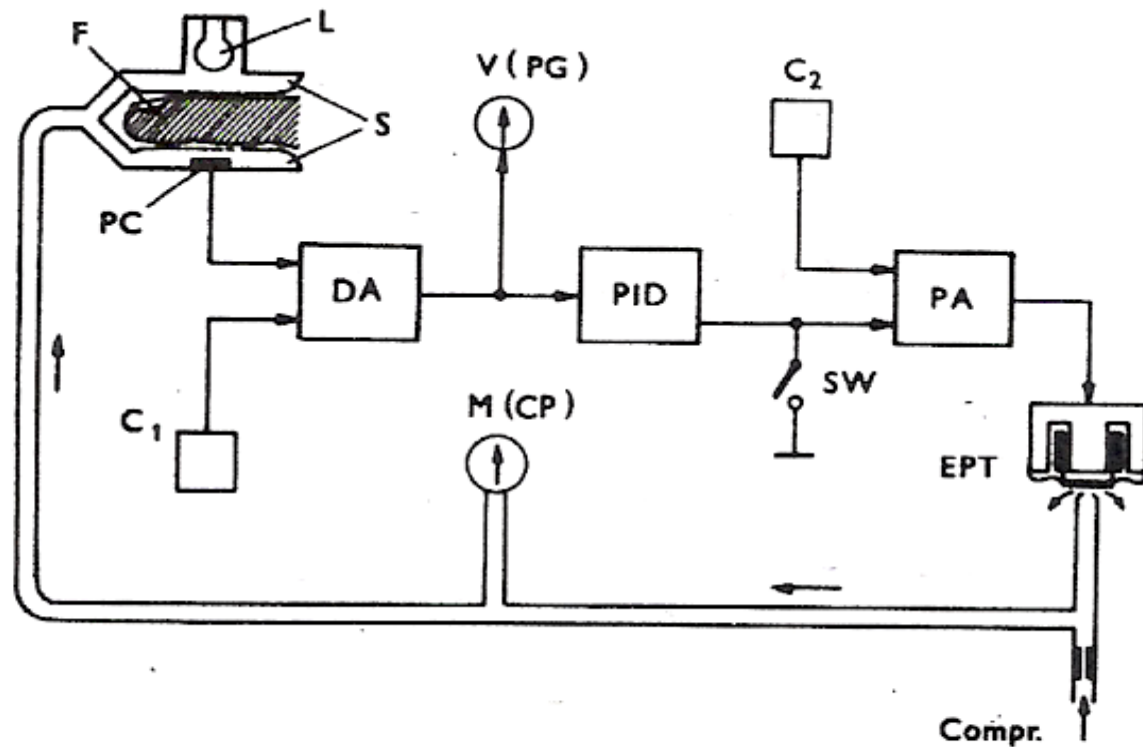


Fig.1. Block diagram of the system. F - finger, L - lamp, PC - photocell, S - segments of transparent pressure cuff, DA - difference amplifier, PID - correcting network, PA - power amplifier, EPT - electro-pneumatic transducer.

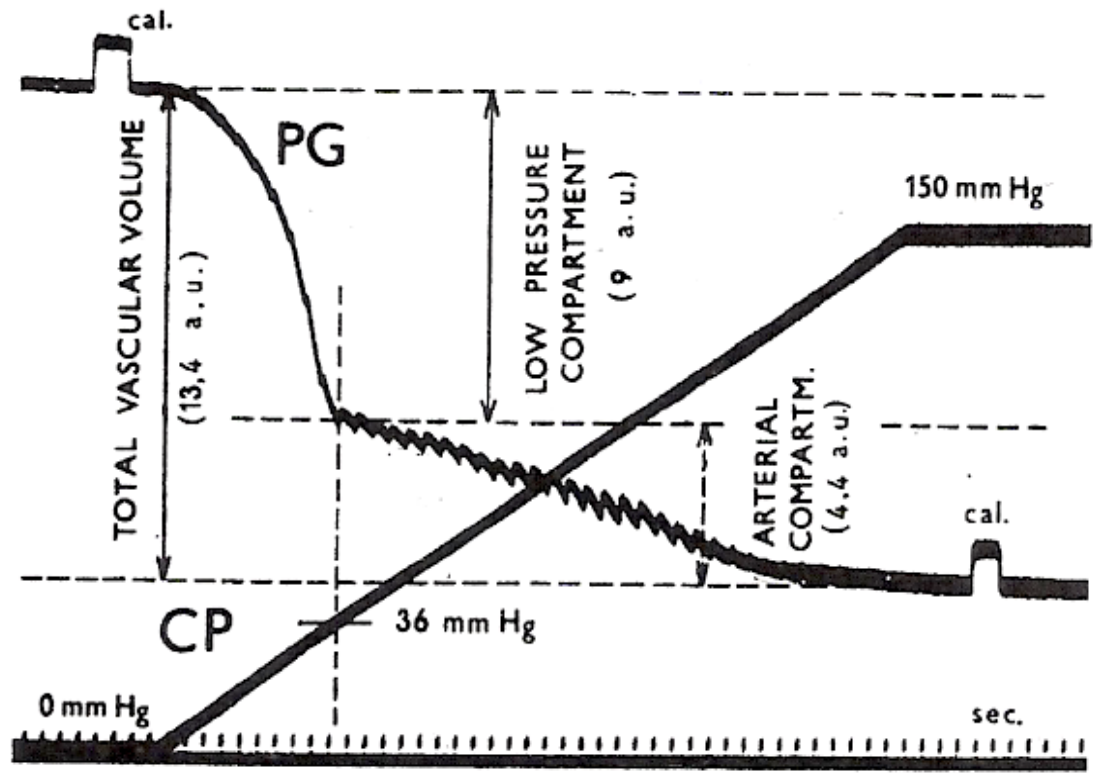


Fig.2. Plethysmogram (PG) during linear increase of cuff pressure (CP).

- We need than **pressure in the cuff corresponded to the pressure of the digital artery**
- **Method: photoplethysmography**
- Recorded photoelectric plethysmogram
- The new term: **Transmural pressure** – P_t (the pressure across the wall of the artery)
- BP, P_c (pressure in cuff), P_t
- We estimated: **$BP = P_c - - - P_t = 0 - - -$**
 photoplethysmogram registered the highest amplitude of oscillation --
 - we measure the **MAP**
- **Step by step** increase of P_c , in the moment of the highest amplitude – **feed-back loop** started for obtained(keeping) the constant volume of the finger

Peňáz patent

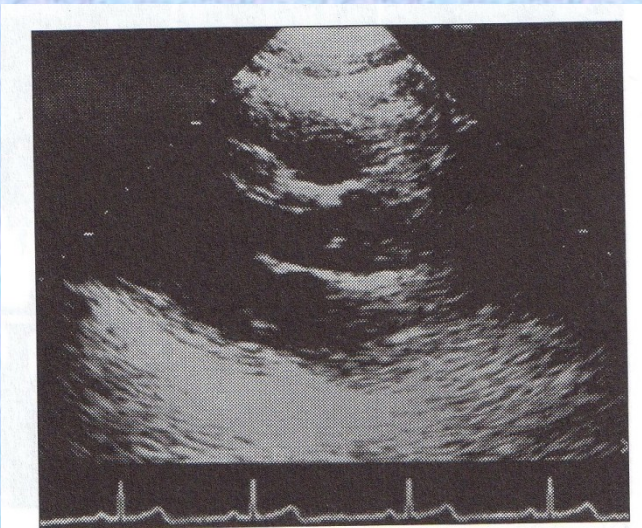
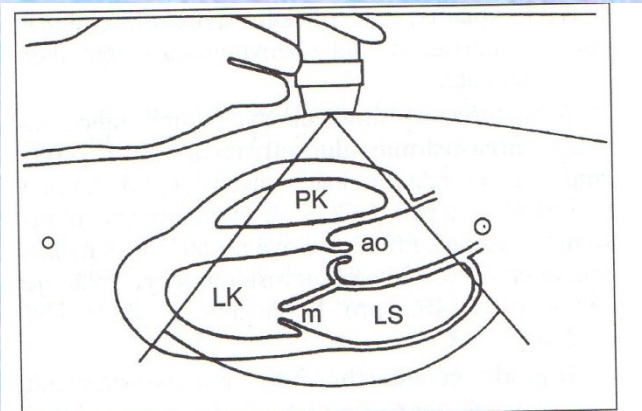
He used the signal from the photocell to control the pressure of the outer cuff so that the volume of the finger did not change.

This has achieved that pressure in the cuff monitors blood pressure in the artery.

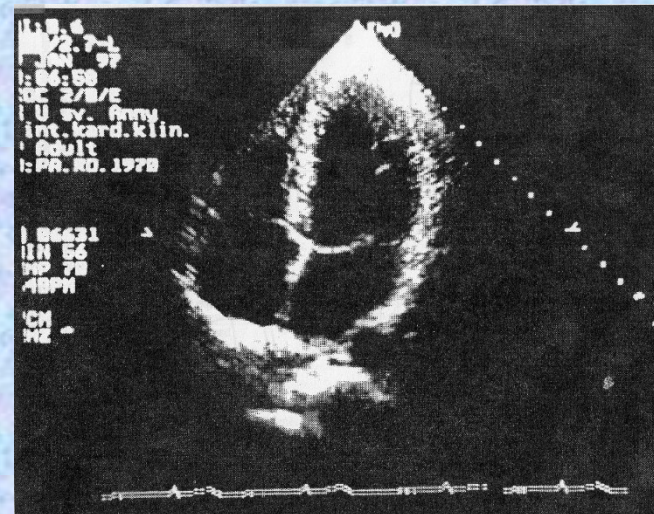
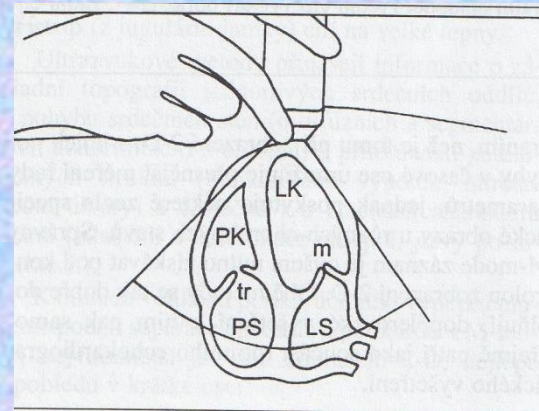
ECHOCARDIOGRAPHY

most widespread methods

PARASTERNAL LONG-AXIS VIEW

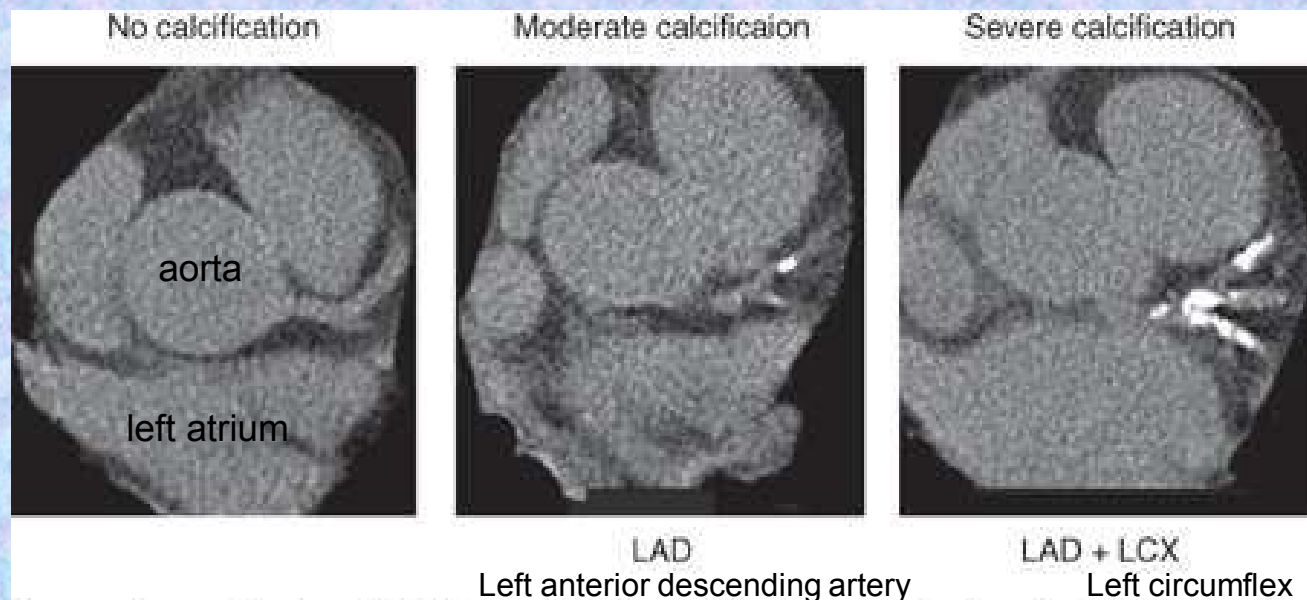


APICAL VIEW



COMPUTED TOMOGRAPHY

- CT is a fast, simple, noninvasive technique that provides images of the myocardium and great vessels;
- CT uses x-rays to create tomographic slices of objects-this is accomplished by rotating an x-ray beam around the object and measuring the transmission of x-rays through the object at many angles, called projections

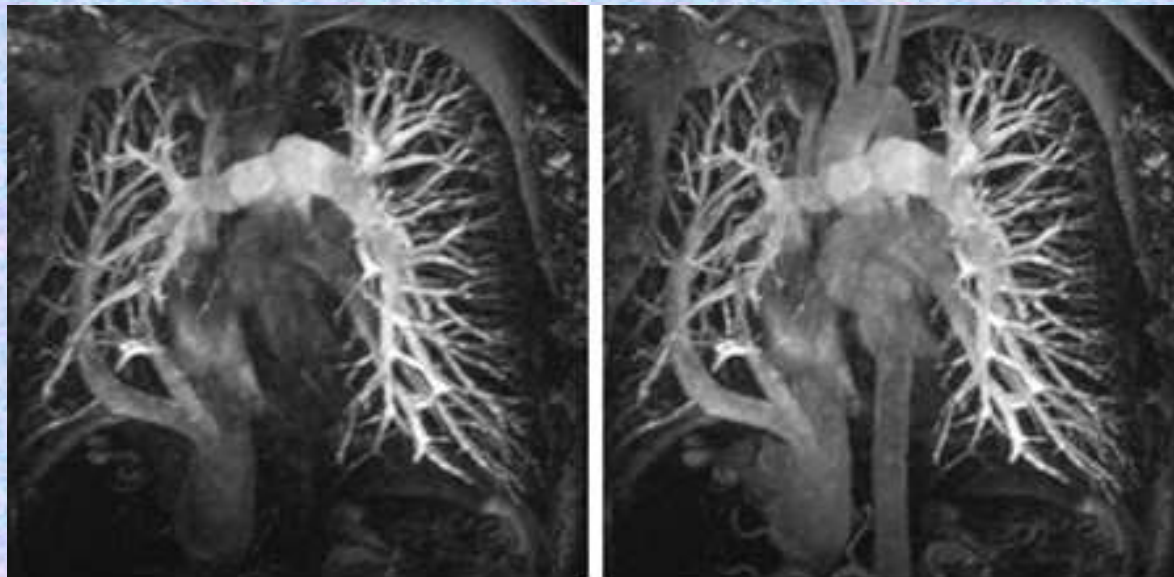


Source: Longo DL, Fauci AS, Kasper DL, Hauser SL, Jameson JL, Loscalzo J: *Harrison's Principles of Internal Medicine, 18th Edition*: www.accessmedicine.com

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MAGNETIC RESONANCE IMAGING

- Based on the magnetic properties of hydrogen nuclei
- Used to quantify accurately EF, ESV, EDV, cardiac mass
- Without the need for ionizing radiation

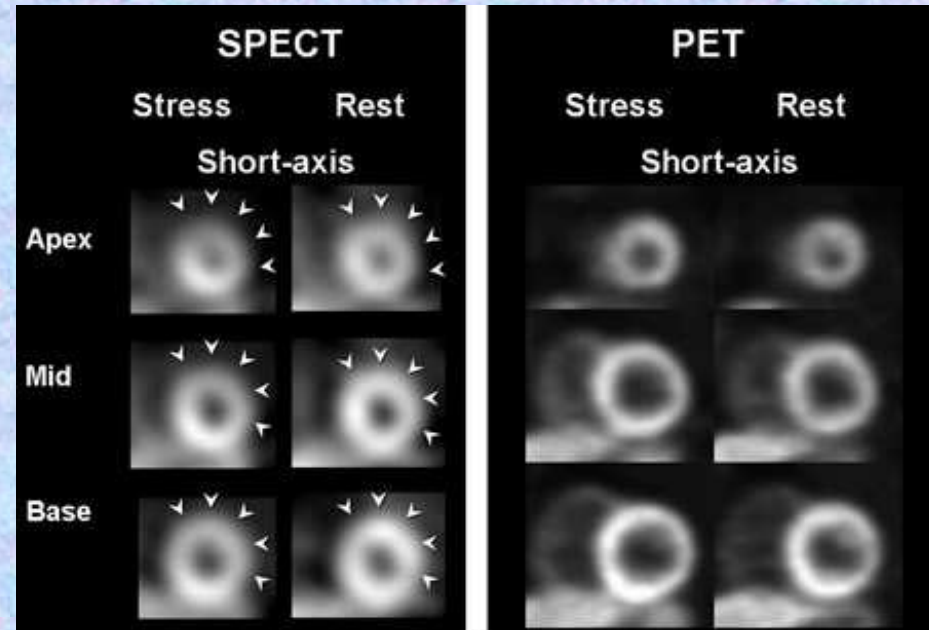


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NUCLEAR CARDIOLOGY

- Nuclear (or radionuclid) imaging requires intravenous administration of isotopes
- Single photon emission computed tomography
SPECT and positron emission tomography
PET



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INVASIVE TECHNIQUES

- **CARDIAC CATHETERIZATION**
- ***Right heart catheterization*** – uses a balloon-tipped flotation catheter that is inserted into the **femoral or jugular vein**. Using fluoroscopic guidance, the catheter is advanced to the *right atrium - right ventricle – pulmonary artery* and *pulmonary wedge position* (as a surrogate for left atrial pressure = wedge pressure)

INVASIVE TECHNIQUE

- **CARDIAC CATHETERIZATION**
- ***Left heart catheterization*** – with the aid of fluoroscopy, the catheter is guided to ascending *aorta* – across the aortic valve into *left ventricle* (inserted into a.femoralis, a.axillaris, a.brachialis)
- A needle-tipped catheter to puncture the atrial septum during right heart catheterization
- **+ *coronary angiography***



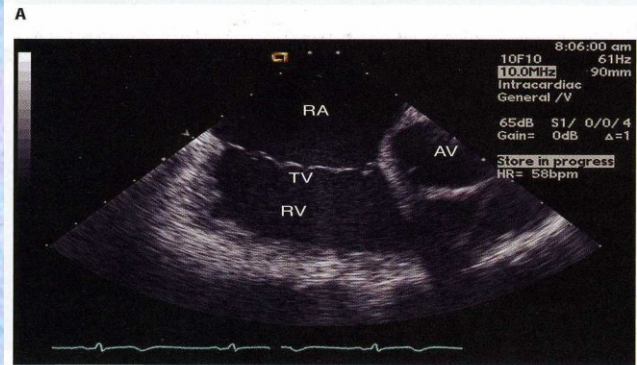
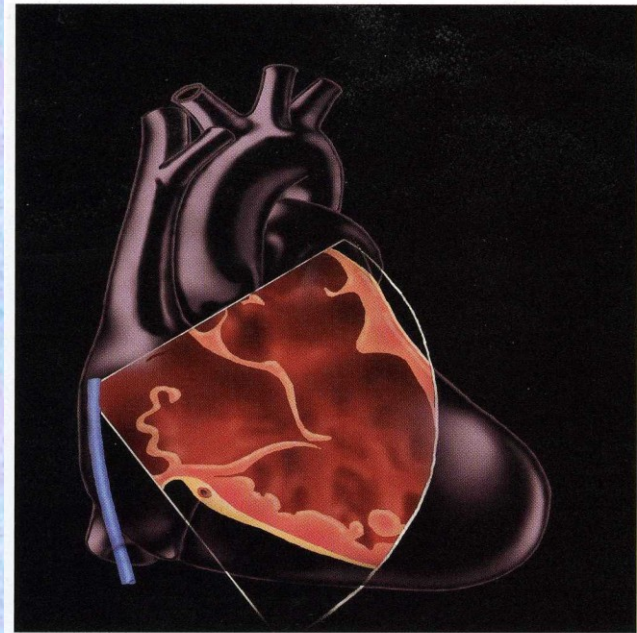
INVASIVE TECHNIQUE

- How do we use cardiac catheterization?
 - ✓ Pressure measurement
 - ✓ Blood flow measurement
 - ✓ Biopsy of tissue
 - ✓ Blood samples for oxygen-saturation analysis to screen for intracardiac shunts
 - ✓ Electric potentials measurement

Intracardiac Echocardiography

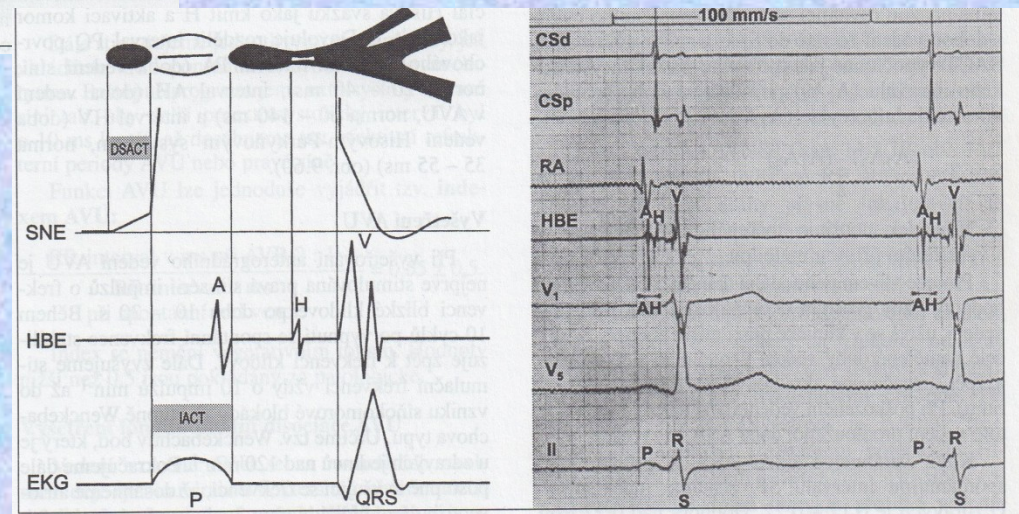
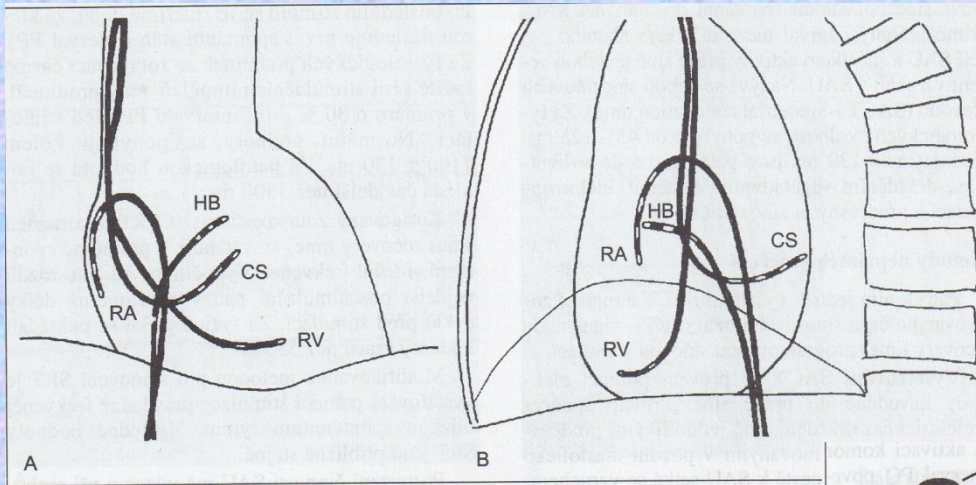
Is an intravascular ultrasound modality that provides diagnostic imaging of cardiac structures from within the heart.

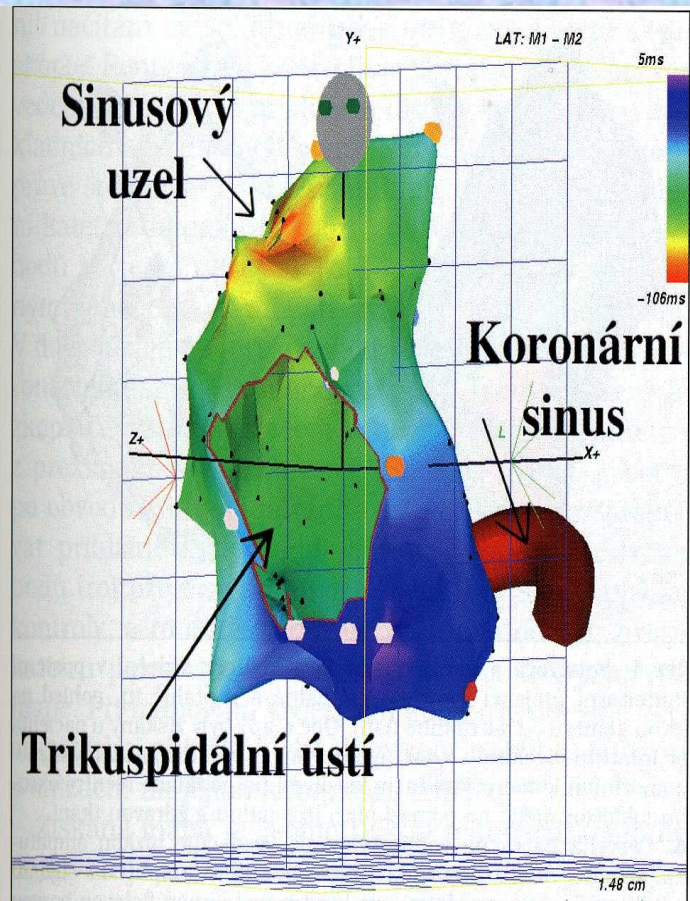
The first catheters used high frequency transducers (20-40 MHz) containing a single ultrasound crystal that rapidly rotated at the end of catheter



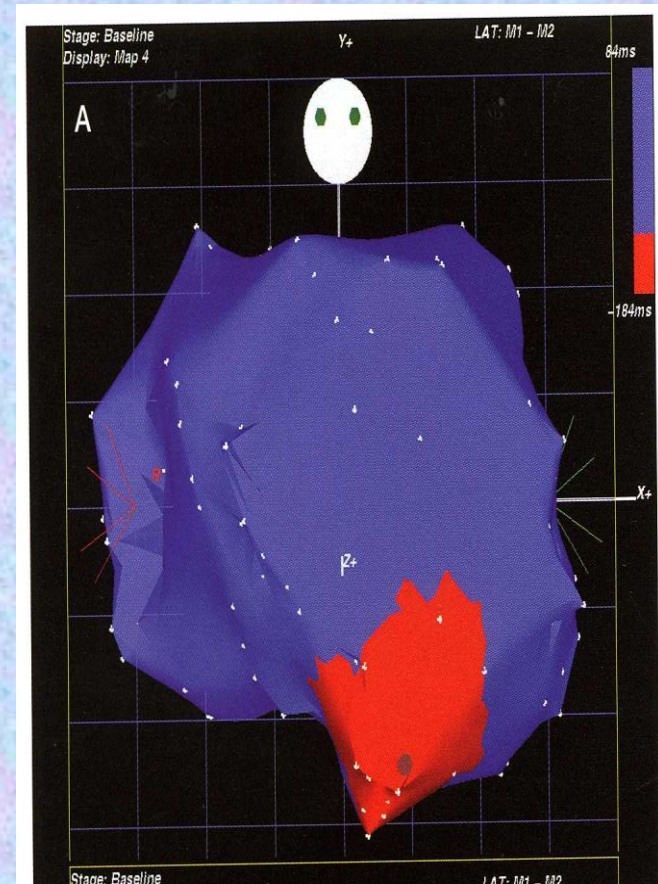
INVASIVE TECHNIQUE

- ELECTROPHYSIOLOGY EXAMINATION

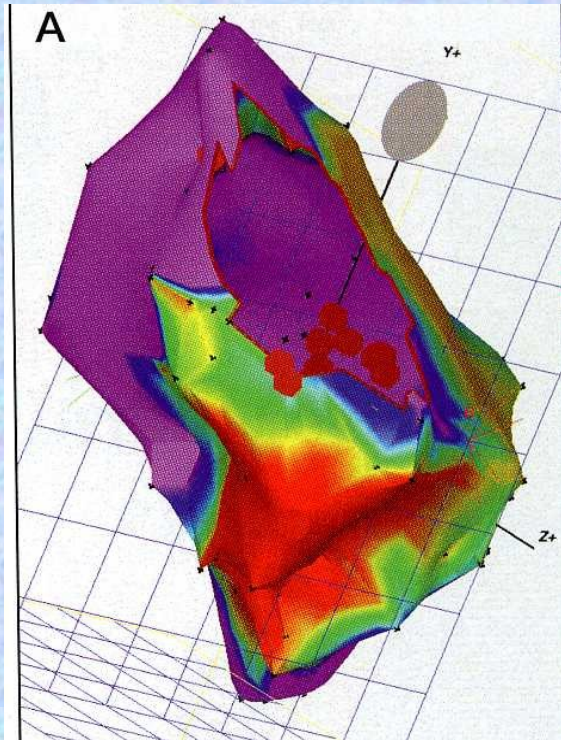




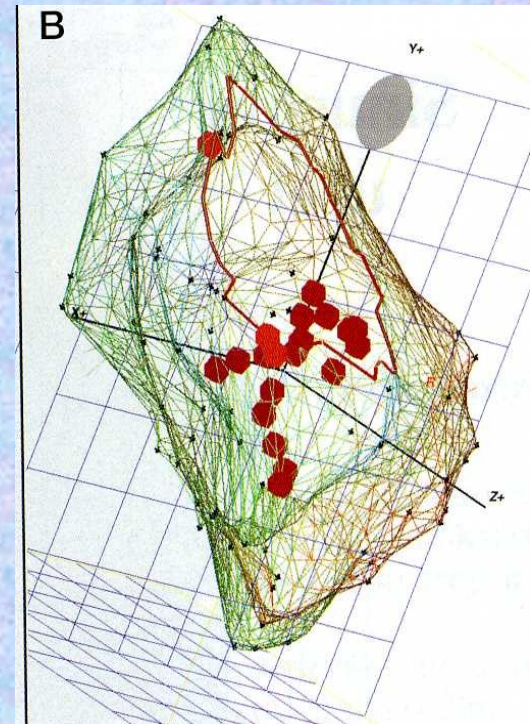
Activation map - Activation map of right atrium in left sloping projection - Sinus rhythm



Activation propagation map - propagation of left ventricular map

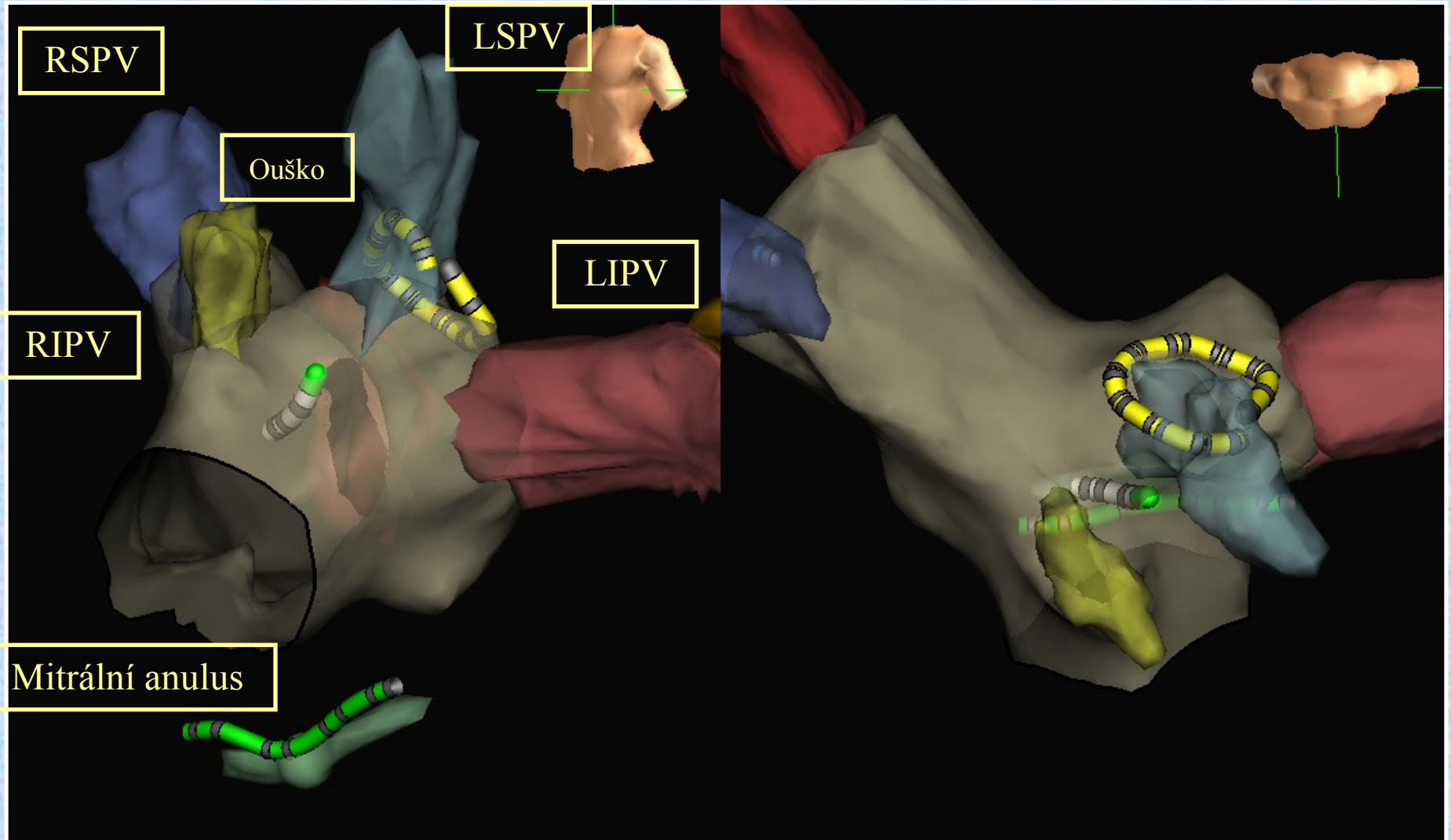


Voltage map – red color – places with a lower voltage, violet – healthy myocardium



Voltage map in network design – visibility of the catheter

Electro-anatomy mapping of left atrium 3D map by system NavX



Radio –frequency ablation - for atrial fibrillation

