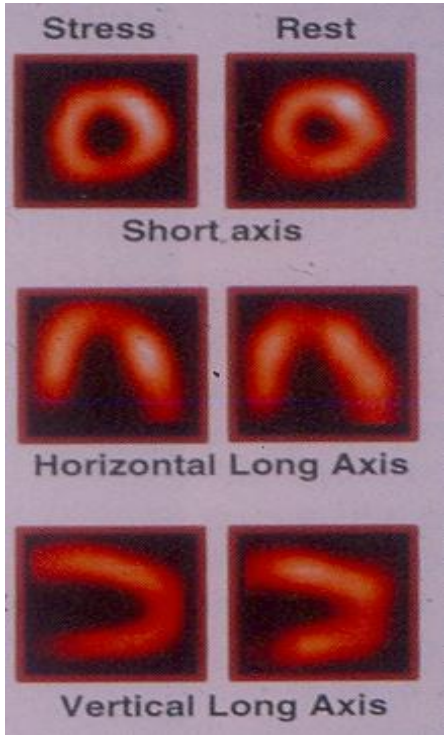
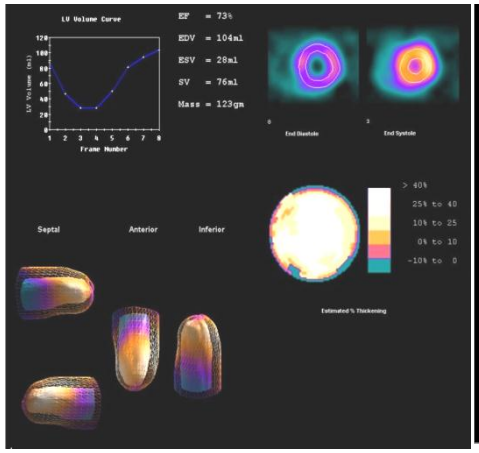
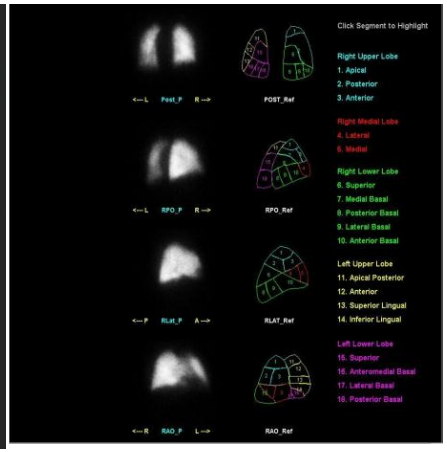
# IMAGING OF HEART, LUNGS AND VESSELS





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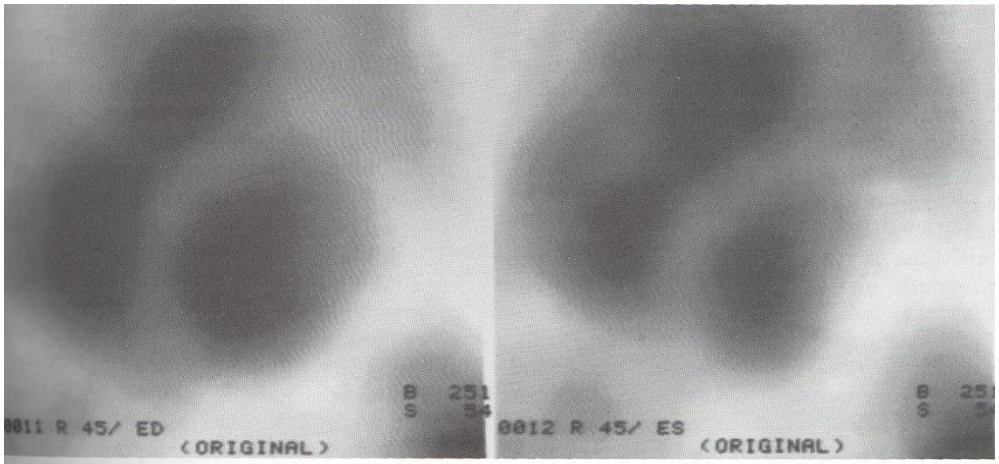
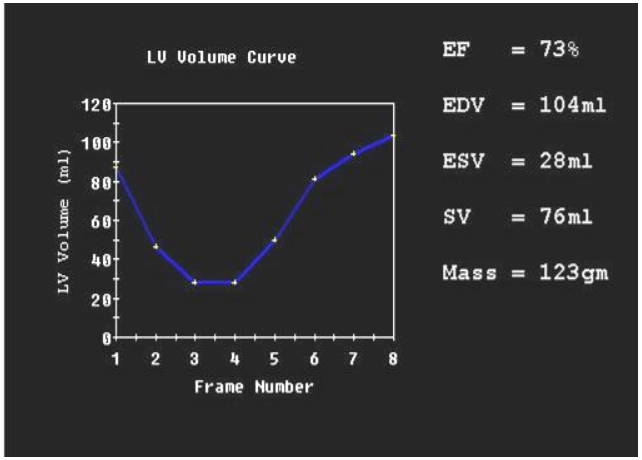
# Radionuclide ventriculography




Slika 3-15. Ekvilibrijska radionuklidna ventrikulografija: ED je snimka srca u teledijastoli, a ES u telesistoli.

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# Radionuclide angiography (RNA)

- Analysis of ventricular wall motion during the cardiac cycle provides information of global ejection fraction (EF) of both right and left ventricule as well as of regional wall motion changes

- First-pass RNA:
  - Tc-99m pertechnetat, iv. bolus injection, 440-740 MBq (12-20 mCi)

- Equillibrium RNA:
  - 1. Tc-99m- red blood cells (labeled in vivo or in vitro)
  - 2. Tc-99m-albumin

- **Equilibrium radionuclide angiography (E-RNA)**
  - Tc-99m – labeled autologous red blood cells
  - ANT
  - LAO 45º (best septal)
  - LL 70º

- Method
  - gama camera
  - computer synchronised with EKG
  - stress imaging
  - multistage treadmill exercise
  - defibrilator

- ED = end diastolic volume (hill)
- ES = end systolic volume (valley)

- Global ejection fraction (GEF) represents relation between stroke volume and diastolic volume of the chamber
- It can be calculated from the formula GEF=1-(ES/ED)

- Global ejection fraction (GEF) for the left and right ventricle

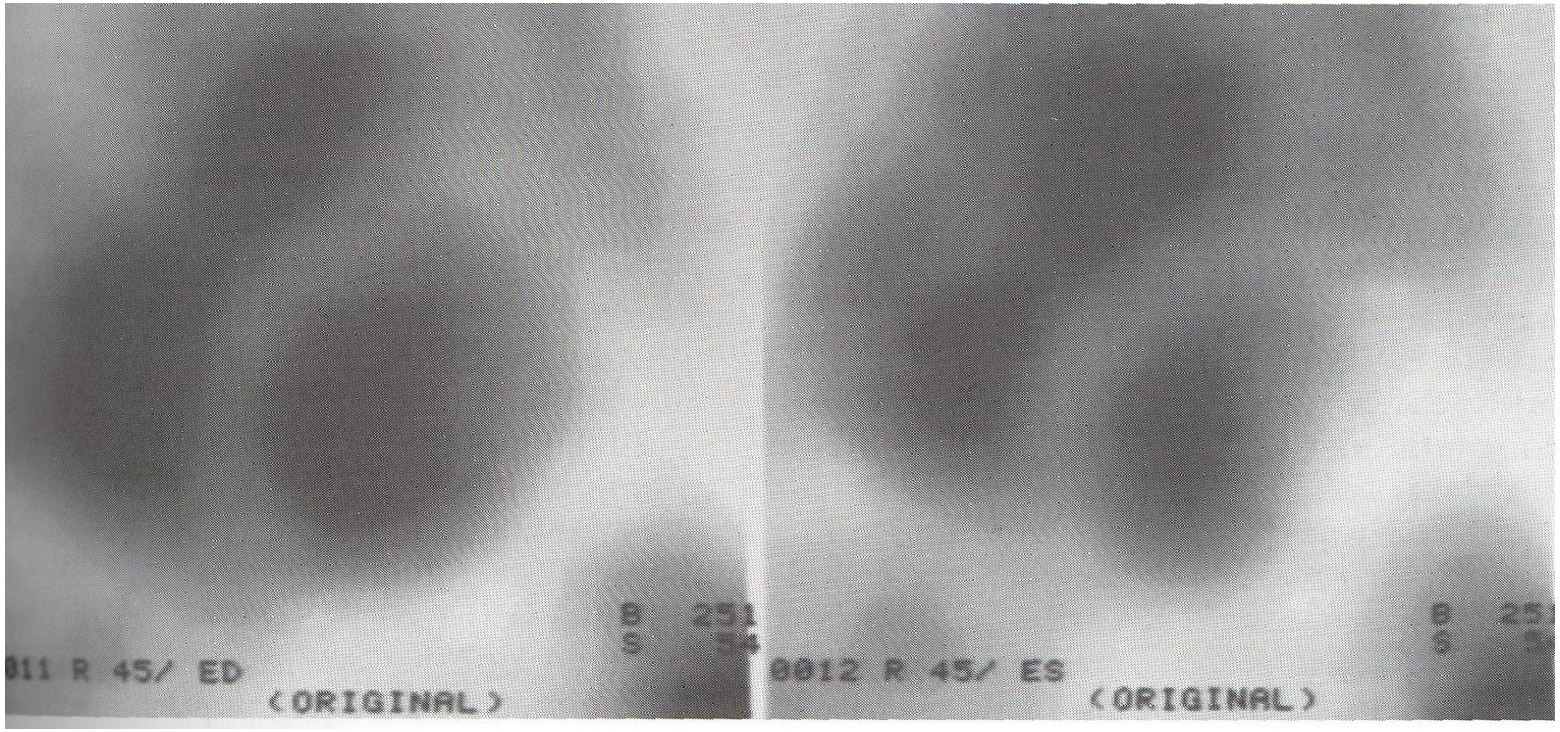
  GEF = SV/EDV

  GEF of the left ventricle ≥ 65%

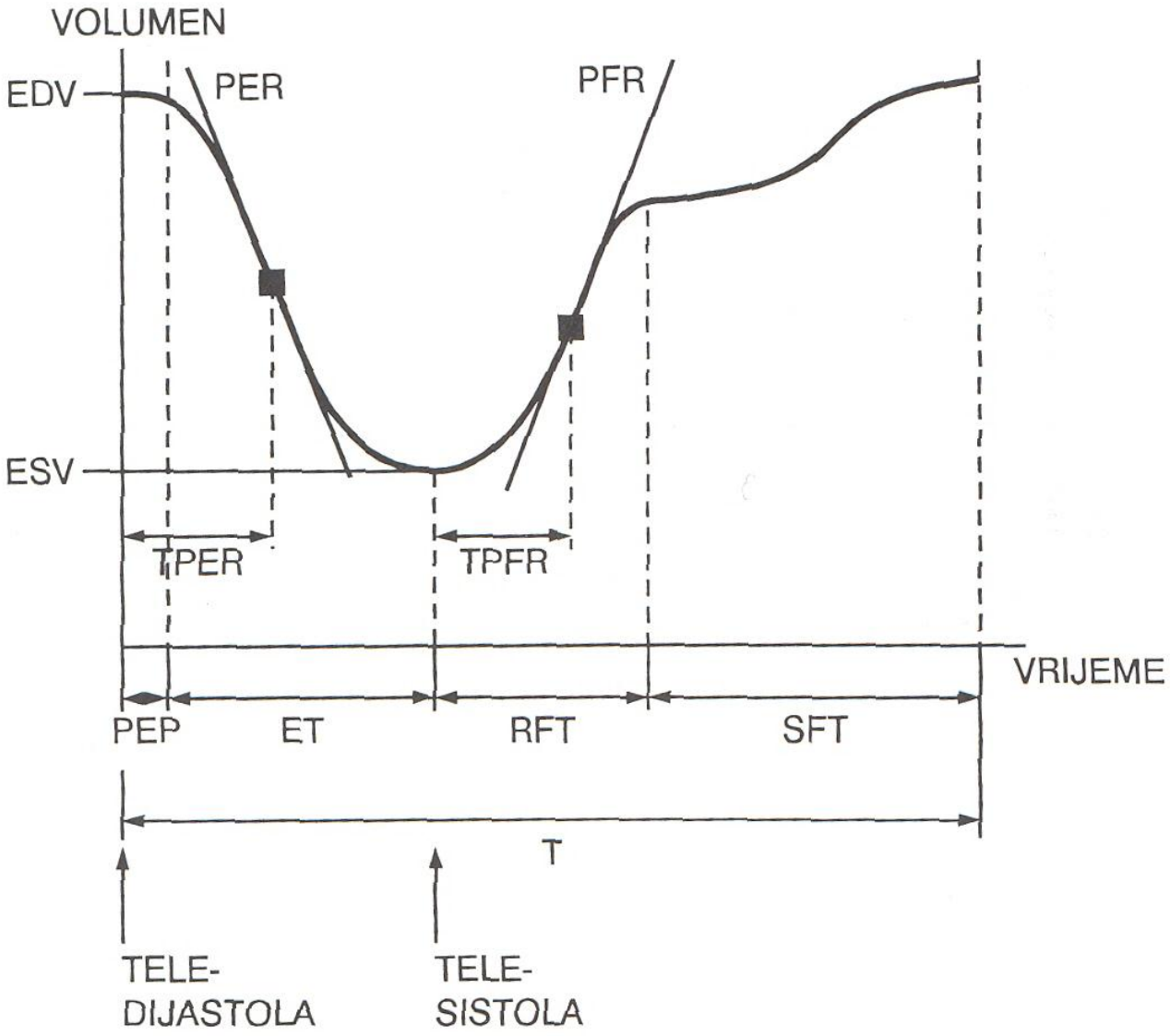
  GEF of the right ventricle >55%

- Regional ejection fraction:
  - Reduced or absent in the area of myiocardial infarction
  - aneurysm of the ventricle demonstrates paradoxal motion

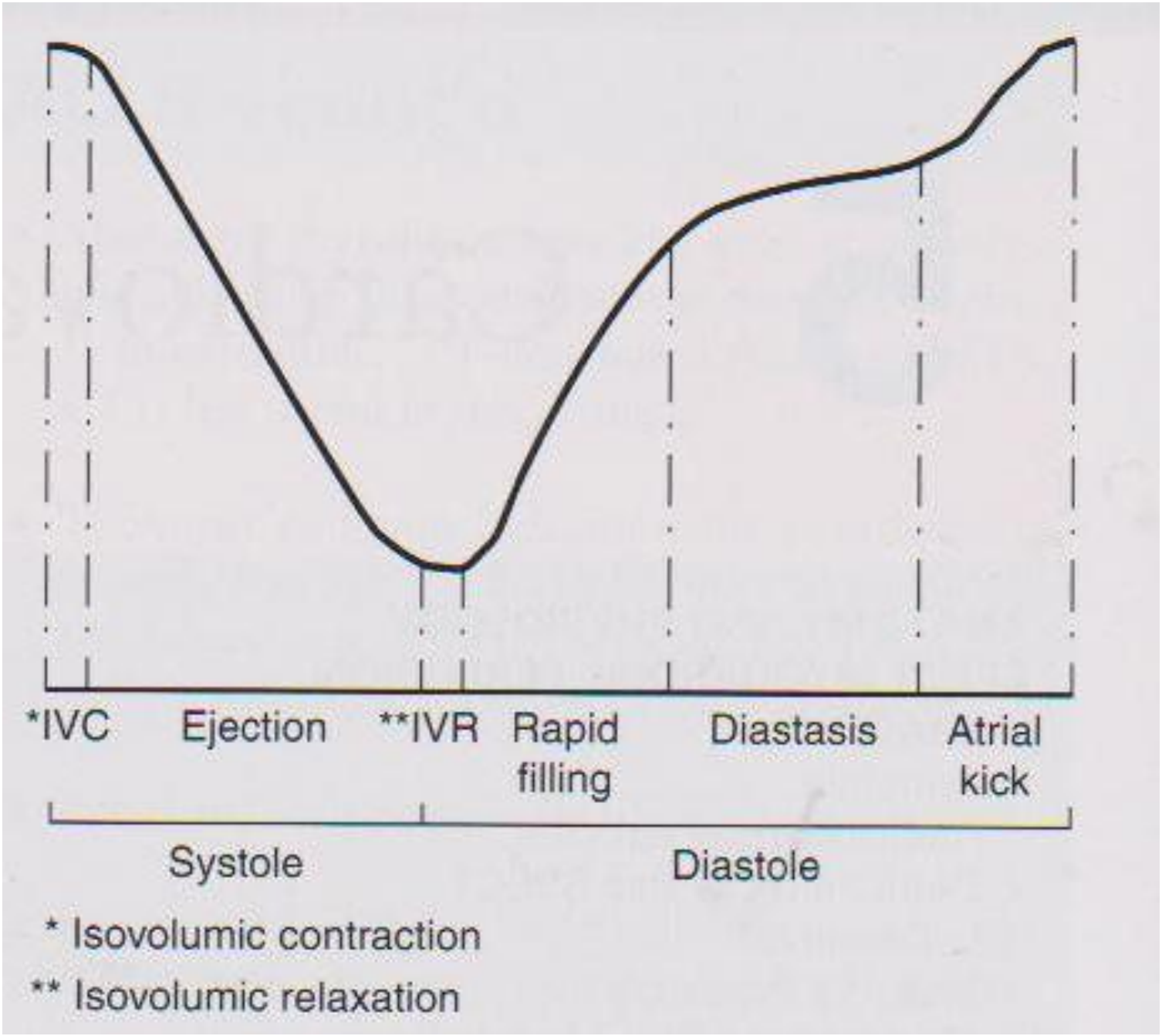
- Indications
  - Coronary disease
  - Cardiomyopthy
  - Cardiac surgery

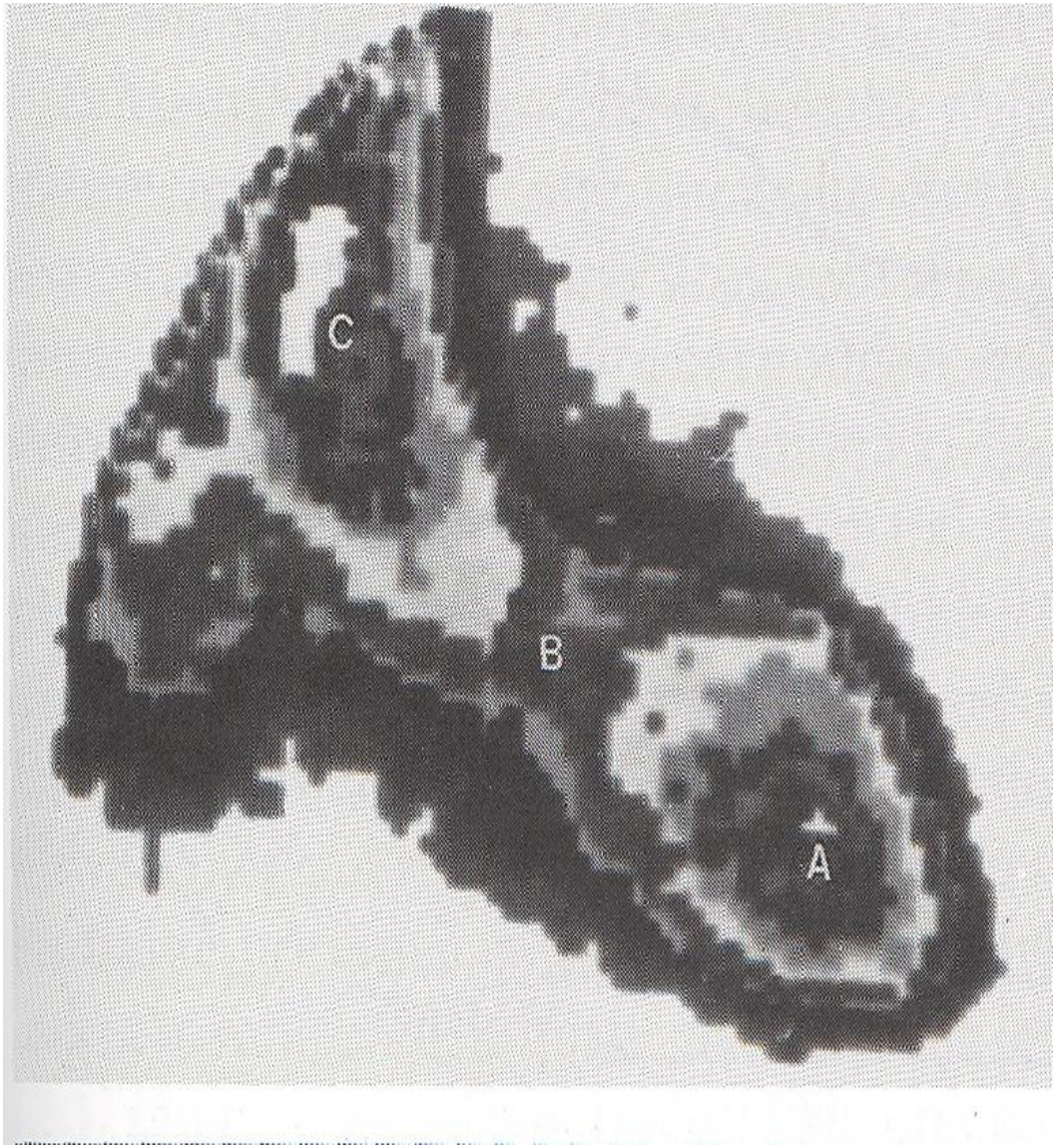



Eqiulibrium radionuclide ventriculography: ED – image of the heart in telediastole, ES image - of the heart in telesystole




**Slika 3-16.** Ekvilibrijska radionuklidna ventrikulografija. Volumna krivulja lijeve klijetke: maksimalna brzina pražnjenja klijetke tijekom sistole, tzv. PER (prema engl. *peak ejection rate*), maksimalna brzina punjenja klijetke tijekom dijastole srca tzv. PFR (engl. *peak filling rate*), vrijeme postizanja maksimalne brzine pražnjenja, tzv. TPER (engl. *time to peak emptying rate*) i vrijeme postizanja maksimalne brzine punjenja, tzv. TPFR (engl. *time to peak filling rate*).

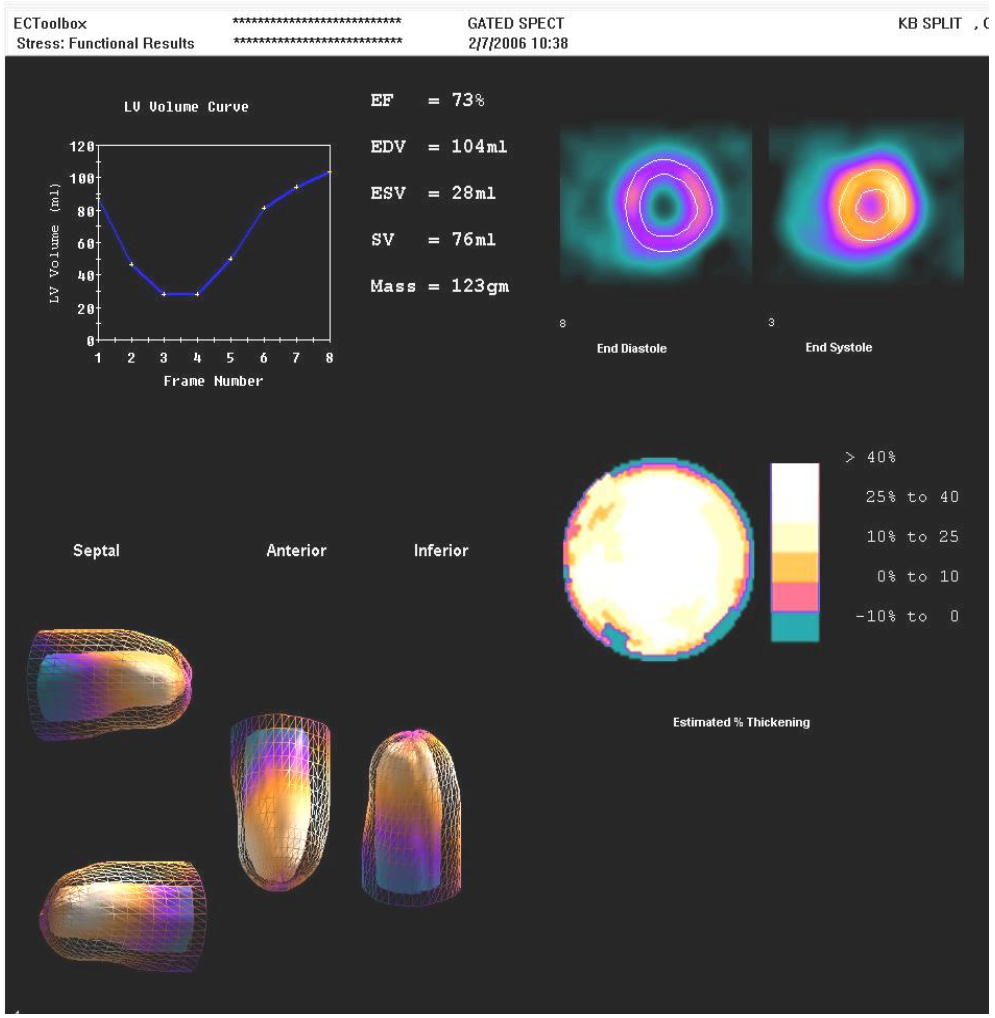

*IVC
Ejection
**IVR
Rapid filling
Diastasis
Atrial kick
Systole
Diastole
* Isovolumic contraction
** Isovolumic relaxation



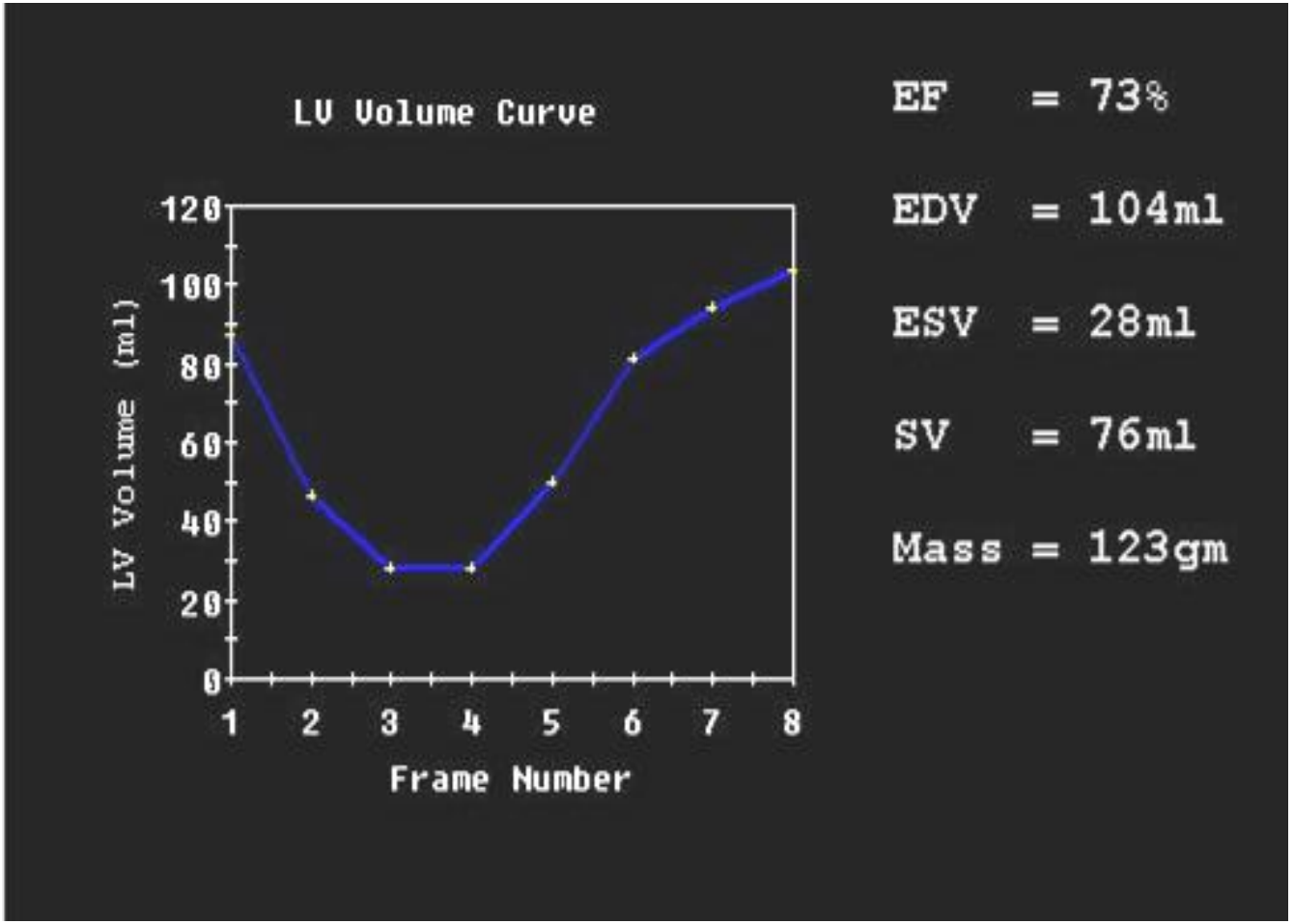

First pass radionuclide angiography. Sumation image of the left ventricule showing: left ventricule (A), aortic valve (B) and aorta ascedens (C)

# GATED SPECT

- ″gated″ scintigraphy
- Synchronised with EKG
- Funcitonal imaging
- Total and regional motion



# GATED SPECT


LV Volume Curve
LV Volume (ml)
120
100
80
60
40
20
0
1
2
3
4
5
6
7
8
Frame Number
EF = 73%
EDV = 104ml
ESV = 28ml
SV = 76ml
Mass = 123gm

# Nuclear medicine imaging of acute myocardial infarction

- Tc-99m- pyrophosphate; 15-20 mCi; imaging after 90 min

- In-111 labeled monoclonal miozin antibodies; 2-3 mCi; imaging after 24 do 48 h.

- Acumulation can be seen both in the active fase of myocarditis and during rejection of the transplanted heart

# Antimyosin- Antibody imaging

Imaging of myocarditis with antimyosin antiobodies in anterior and left anterolateral projection. There is diffuse patological accumulation of antibodies in myocard and physiological accumulation in the liver and kidneys

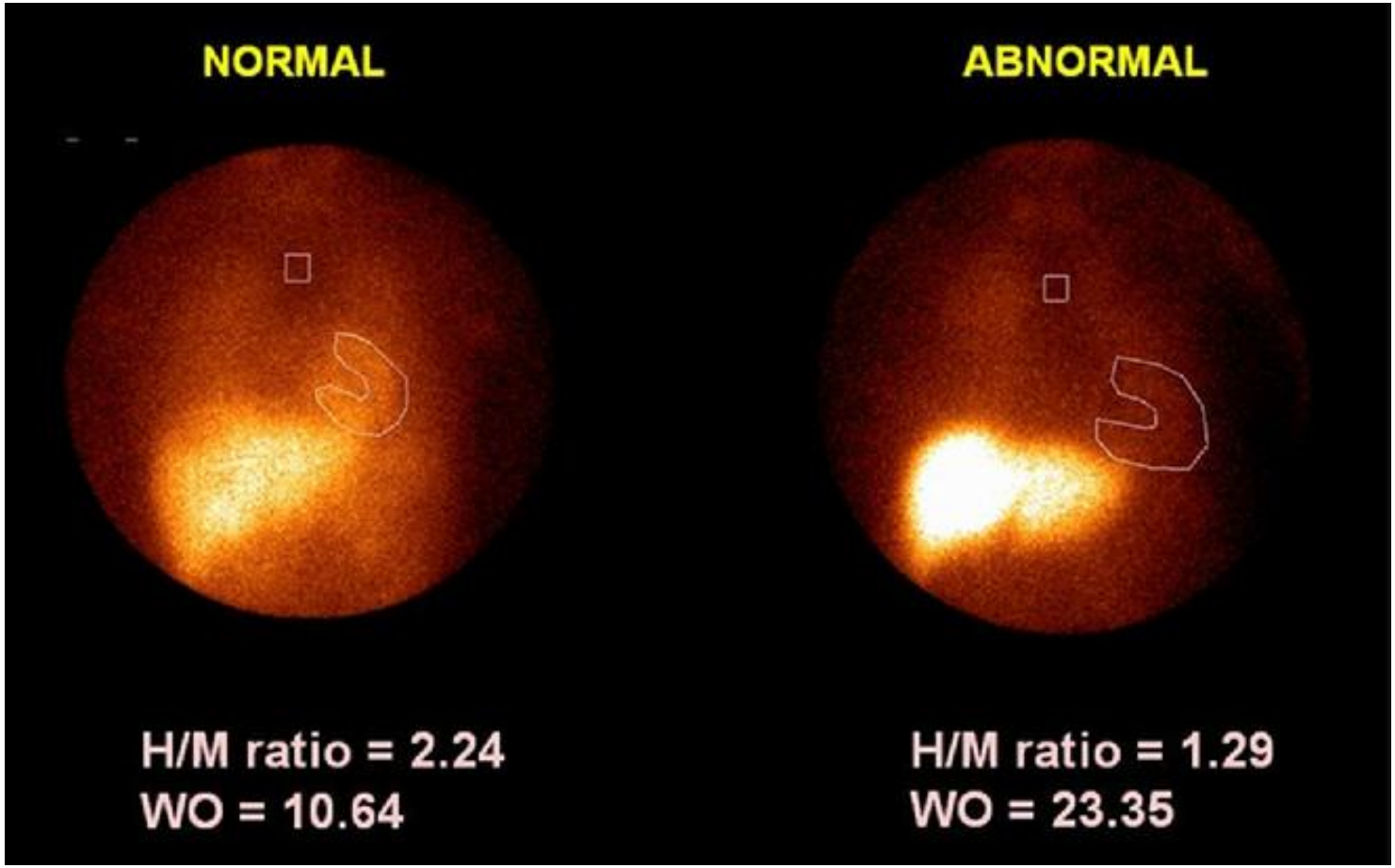
# Myocardium inervation imaging

- **MIBG** (metajodobenzilgvanidin) – labeled with the I-131 or I-123
- Dosage:
  - I-131 MIBG - 18,50 MBq (0,5 mCi) i.v.
  - I-123 MIBG - 185 MBq (5mCi) i.v.
- Imaging begins 15 min after injection, and lasts up to 4 hours

# Indications: reduction of myocardial accumulation of MIBG

- after heart transplantation

- diabetic neuropathy combined with ishemic congenstive and hypertrophic cardiomyopathy, heart failure, postinfarction myyocardial scar, ventricular arrythmia

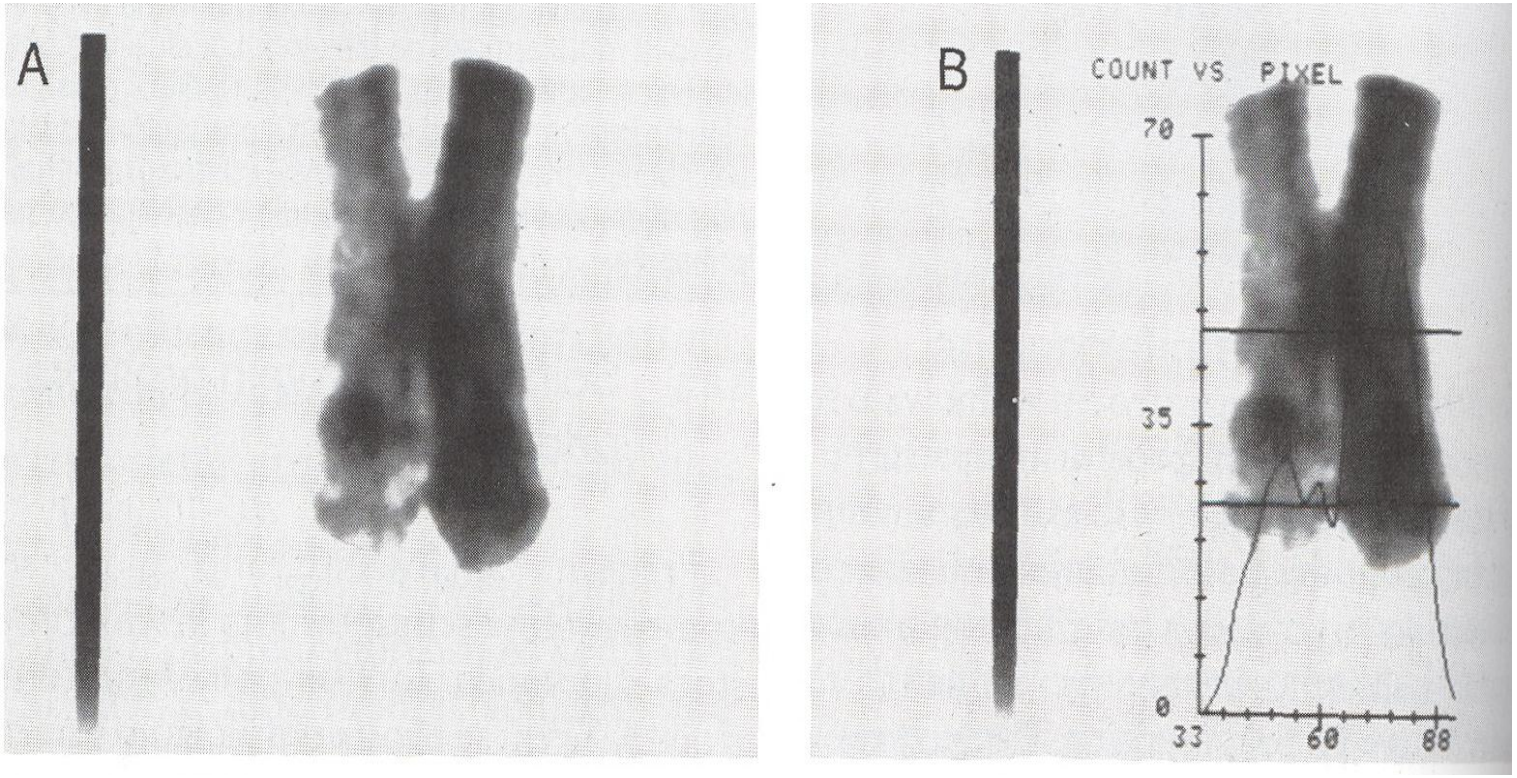



Examples of planar cardiac 123I-*mIBG images. The example* on the left shows normal cardiac 123I-*mIBG uptake with a H/M ratio* of 2.24 and a normal tracer washout (WO) from initial to delayed images of 10.64%. The example on the right shows an abnormal H/M ratio of 1.29 in images with an abnormal tracer washout of 23.35%.

# Periferal angioscintigraphy

- Patency of large pelvic arteries, arteries of upper and lower limbs
  - 444-740 MBq (12-20 mCi) Tc-99m pertechnetate
  - Tc- 99m DTPA
  - Tc- 99m – labeled red blood cells

- Indications
  - Acute thromboembolisam
  - Patency of arteries after therapy
  - Foot perfusion (obliteration disease)
  - Hand perfusion (Syndroma Raynaud)




Morbus Bürger: (A) Blood pool imaging of distal part of cruris and foot is showing faint accumulation of labeled erytrocytes on the right cruris and on the right foot – arteriographicly and clinicly varrified oclusion of the big cruric and foot artery arteries on the right
(B) Faint circulation of the  right foot.

# Thromb scintigraphy

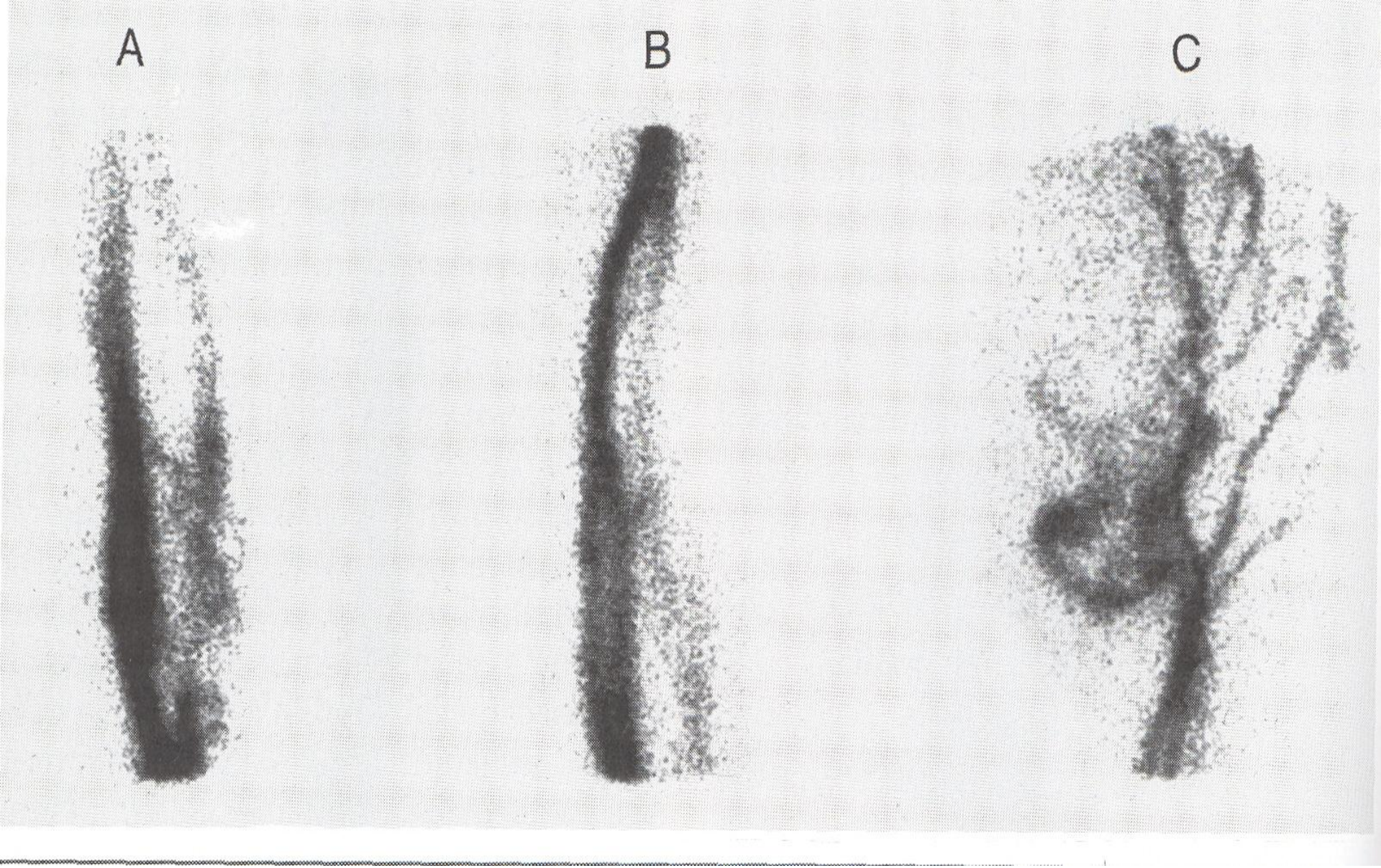
- I -123 or Tc-99m labeled fibrinogen: for the detection of venous thromb

- In-111 labeled thrombocytes: for the detection of atrterial thromb

# Indications

- Deep vein thrombosis
- Follow up and assesment of surgical and conservative therapy of deep vein thrombosis of limb or pelvic vessels
- Pulmonary emboly caused by thrombus of unknown origin
- Assesment of venous filters patency (cava-filter)
- Unavailable radiophlebography
- Differentional diagnosis of leg edema
- Differentional diagnosis of muscle rupture and phlebothrombosis

# Phleboscintigraphy




Phlebothrombosis of left iliac vene

The end!