



# Kazan State Medical University



topic :radionuclide examination of  
urinary tract

sunny bhasal  
Group 1317

A purple wavy line graphic consisting of four connected curves, resembling a stylized 'M' or a series of peaks and valleys.

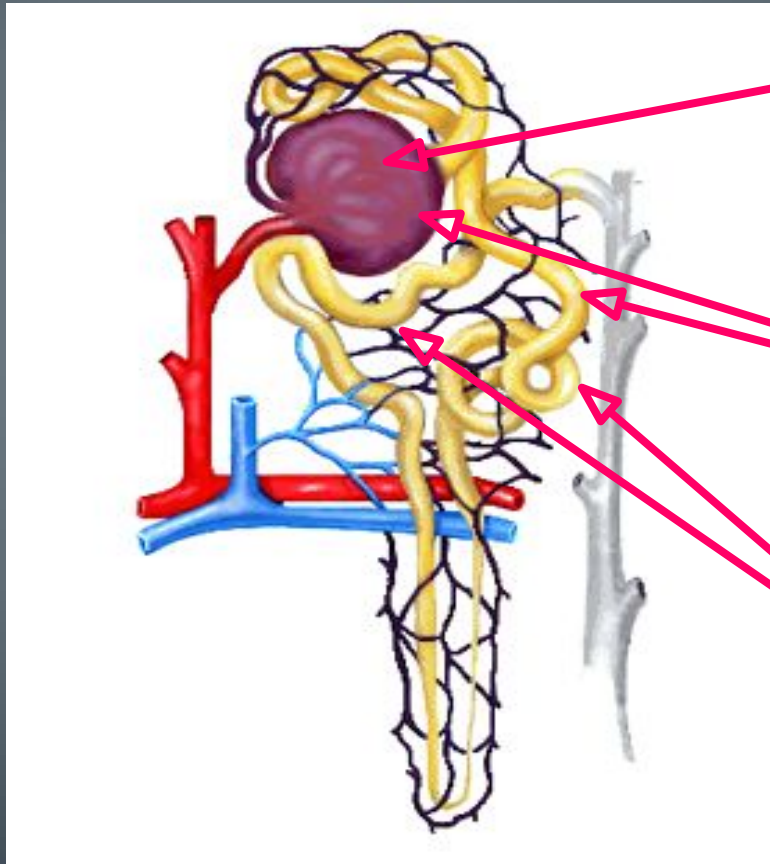
# Radionuclide diagnostics methods

- Noninvasive
  - Are primarily physiologic
    - Functional
- Does not provide the same anatomic details
  - As morphologic method (X-ray,US,CT,MRI)

# Radiopharmaceuticals

## Mechanisms of excretion

you can see in the picture



### Glomerular filtration

$^{99m}\text{Tc}$  DTPA



### Tubular secretion

$^{99m}\text{Tc}$  MAG3

$^{131}\text{I}$ ,  $^{123}\text{I}$  – OIH



### Tubular fixation

$^{99m}\text{Tc}$  DMSA

$^{99m}\text{Tc}$

# Radionuclide Examination

- **Nuclear medicine** is a medical specialty involving the application of radioactive substances in the diagnosis and treatment of disease.
- In nuclear medicine procedures, radionuclides are combined with other elements to form chemical compounds, or else combined with existing pharmaceutical compounds, to form radiopharmaceuticals. These radiopharmaceuticals, once administered to the patient, can localize to specific organs or cellular receptors
- There are several techniques of diagnostic nuclear medicine.
  - Scintigraphy
  - PET
  - SPECT

The radiotracer, injected into a vein, emits gamma radiation as it decays. A gamma camera scans the radiation area and creates an image.



Gamma  
camera



# Radionuclides

- Three basic classes of radionuclide are employed in nuclear renography.
  - Filtered agents
  - Excreted agents
  - Cortical imaging agents

## Filtered Radionuclides

- DTPA and MAG3 are filtered through the glomerulus. This is useful in evaluating:
  - Perfusion
    - Vascular supply
  - Filtration
    - Measuring renal function (glomerular filtration rate)
  - Drainage
    - Detects obstruction

## Excreted Radionuclides

- MAG3 and Hipuran are excreted by the renal tubules.  
These radionuclides are helpful in evaluating patients with:
  - Diminished renal function
  - Kidney transplants
- MAG3 is both filtered and excreted so some radiologists prefer it to other radionuclides



## Cortical Imaging Radionuclides

- DMSA and Glucoheptonate are accumulated in the cortex so they are helpful in evaluating:
  - Renal scarring from chronic infection
  - Infarction
  - Renal mass
  - Differential renal mass (proportion of total renal mass contributed by each kidney)

## Radionuclide examination

- There are two main radionuclide techniques for studying the kidneys:
- The Renogram which measures renal function. Scans of renal morphology (DMSA scan). The advent of CT and ultrasound has reduced the need for such scans. They are now used mainly for evaluating renal scanning.



Photograph of a bone scanner  
Copyright © Cancer Research UK

## Radiopharmaceuticals

### **$^{99m}\text{Tc}$ -DTPA – Diethylenetriamine pentaacetic acid**

**belongs to the group of chelate compounds  
is excreted from kidneys through glomerular filtration  
with a half-life of 70 minutes  
it is the most suitable substance  
for measuring glomerular filtration (GFR)  
and good imaging of renal parenchyma**

## Radiopharmaceuticals

### **$^{99m}\text{Tc}$ -MAG3 - Mercapto-acetyltriglycine**

- is one of the newly developed radiopharmaceuticals
- is rapidly excreted by the kidneys via active tubular secretion and minor part via glomerular filtration
- organic anions (which include MAG3) have a carboxyl group which specifically binds to the receptors of tubular cells mediating the active transport of MAG3 into the cells of the proximal tubulus
- with normal renal function 70% of the administered activity of the radiopharmaceutical (RP) is excreted within 30 minutes after the application

# Dynamic renal study

## Radiopharmaceutical

**99mTc - MAG3**

## Patient Preparation

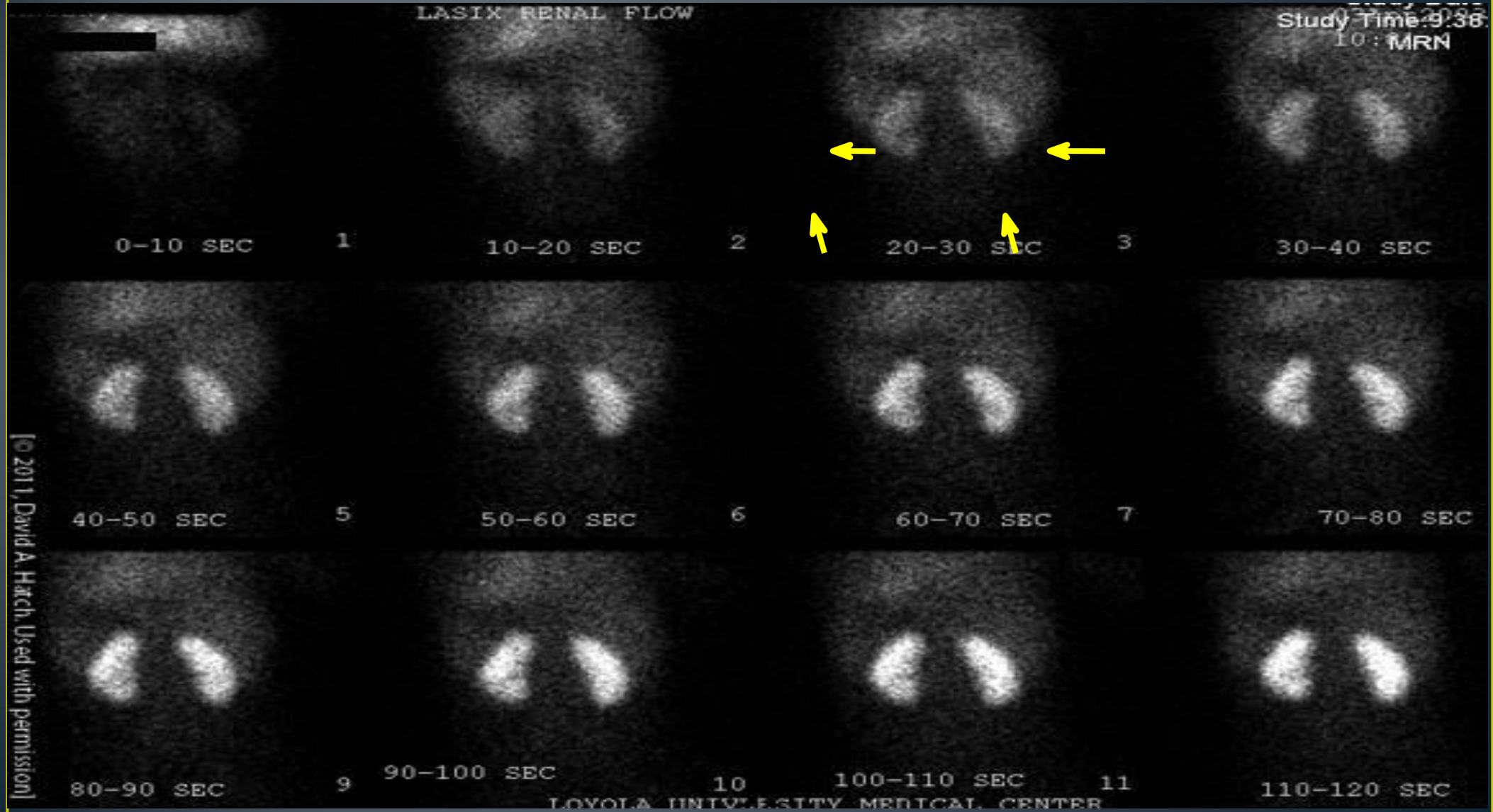
**adequately hydration prior to the examination**

it is recommended to drink 100 ml of liquids per 10 kg of the body weight 30 min prior the examination

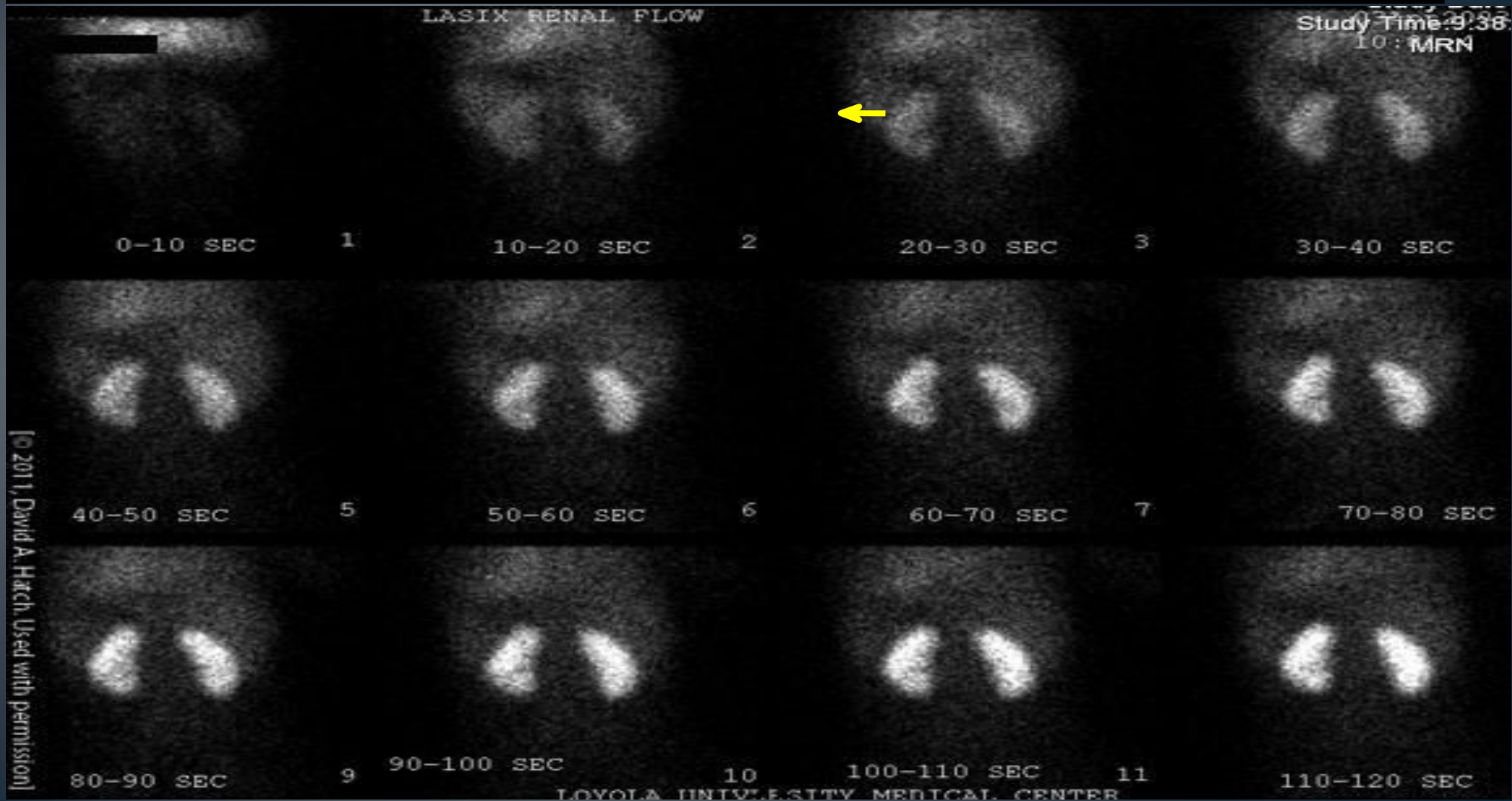
**empty bladder**

**p. are requested to void completely prior to the study**

# Perfusion Panel

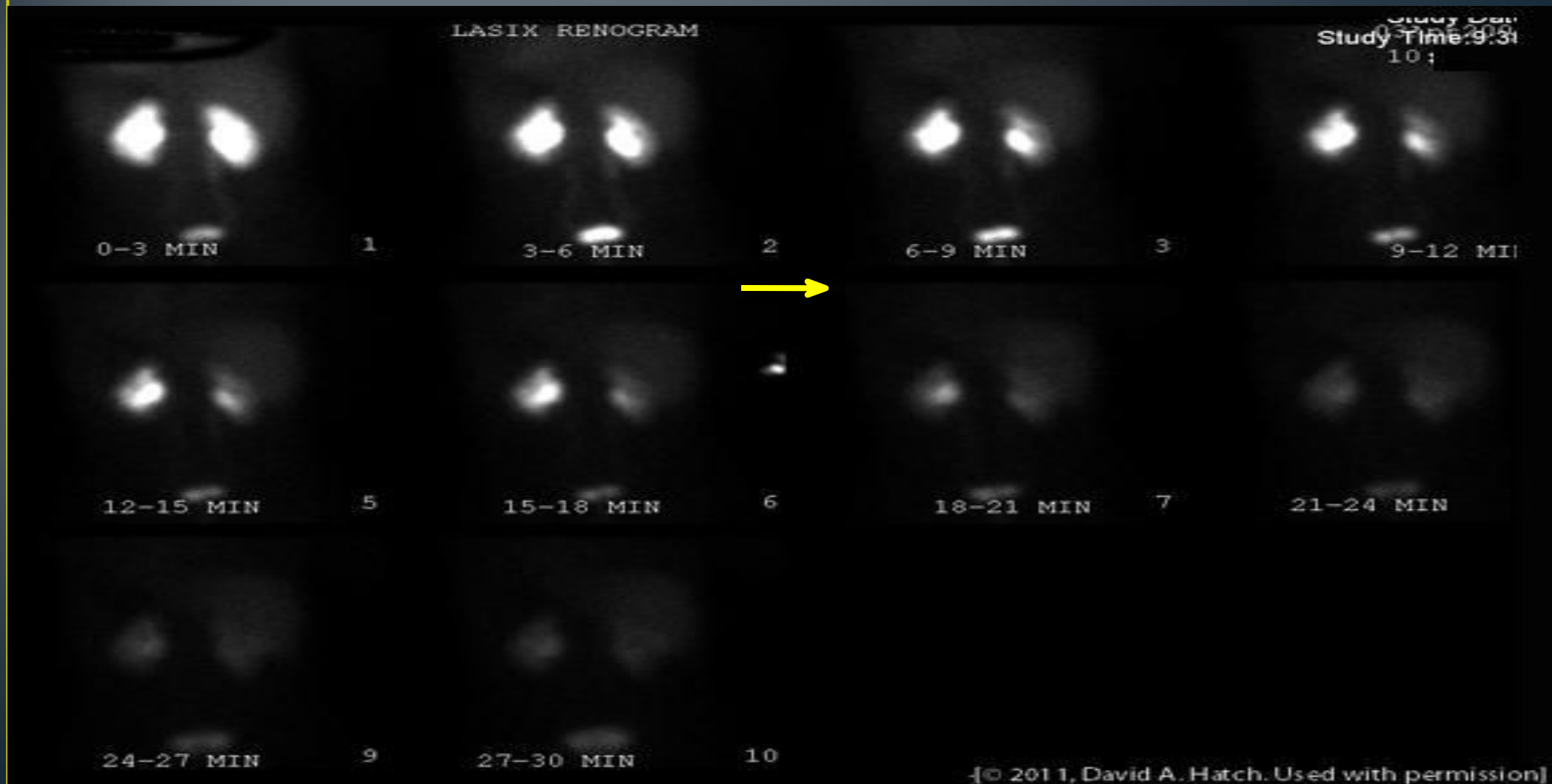


# Perfusion Panel



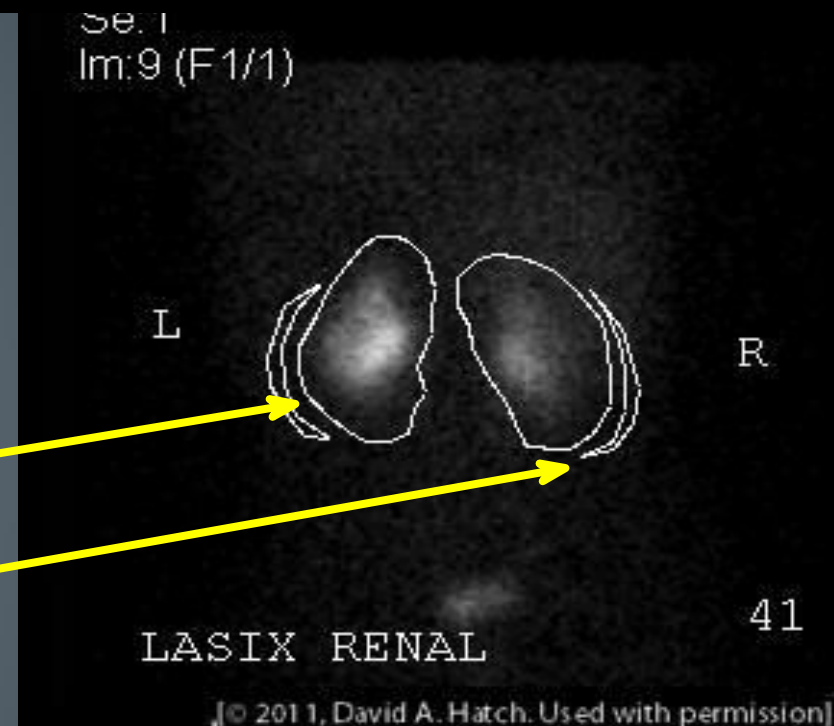


# Excretion / Drainage Panel



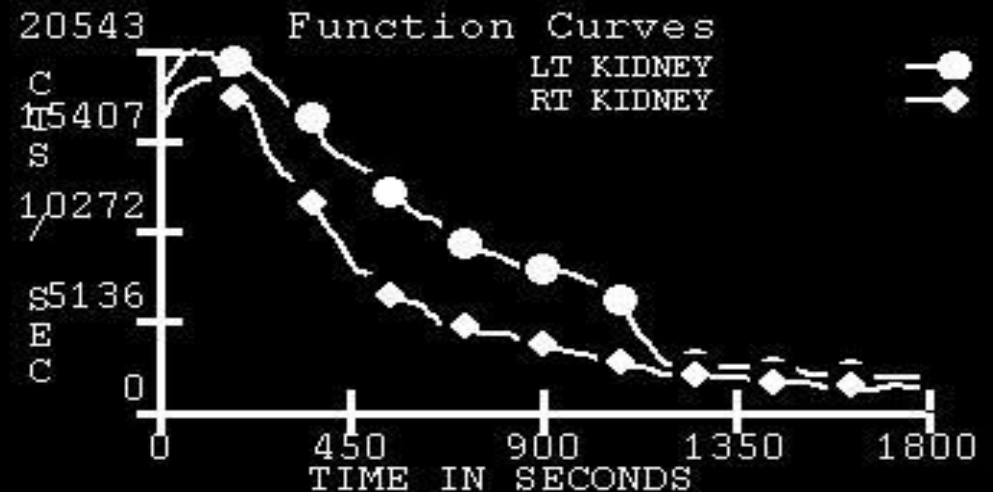
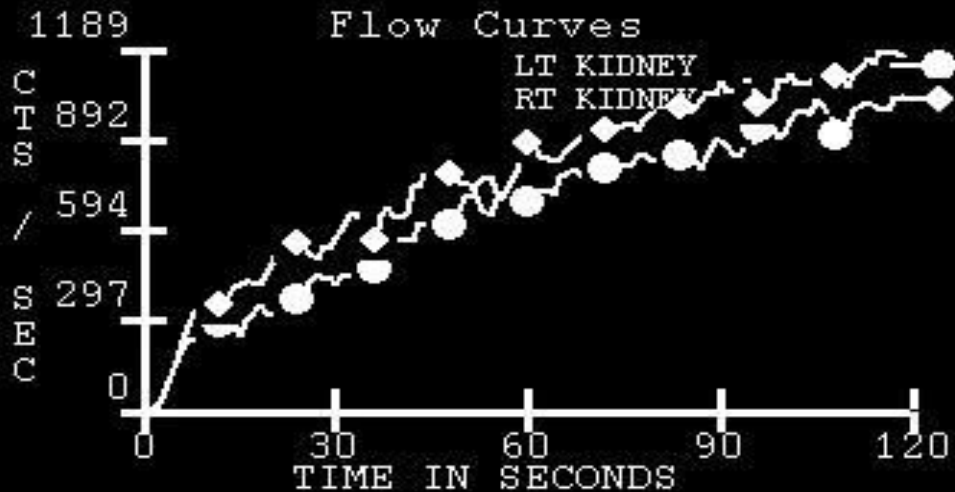
## Curves / Analysis Panel

- Area of interest
  - This is a graphical representation of the area from which radioactivity is measured in the analysis. There are two such areas for each kidney.
    - Kidney area
    - Background area
  - The radioactivity detected in the background area is subtracted from that detected from the kidney to eliminate background noise.



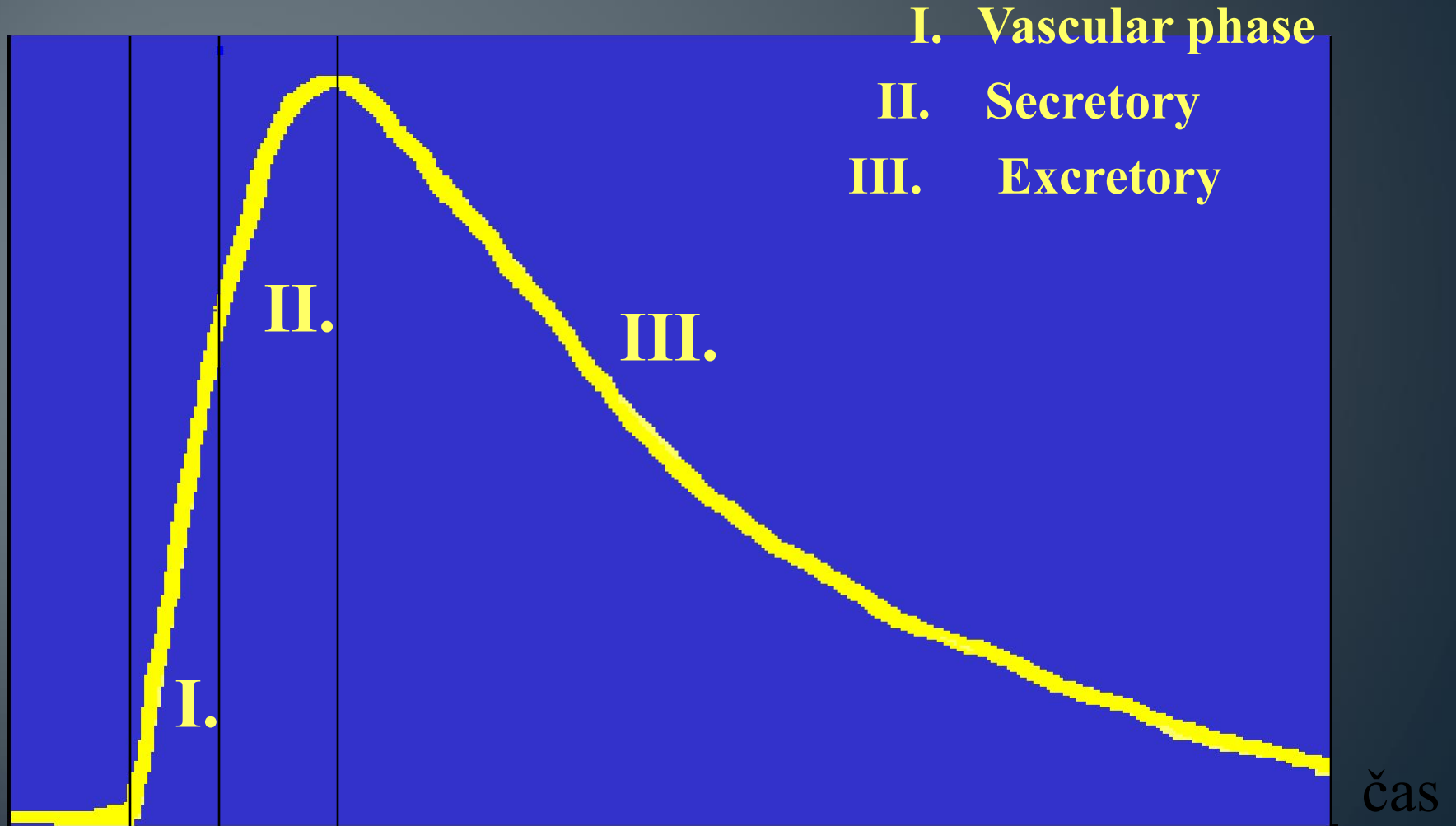
## Look at some normal curves.

- Normally, the curves show rapid uptake (flow curve on left) and rapid drainage (function curve on right). Each kidney is plotted separately (see labels) on each graph.



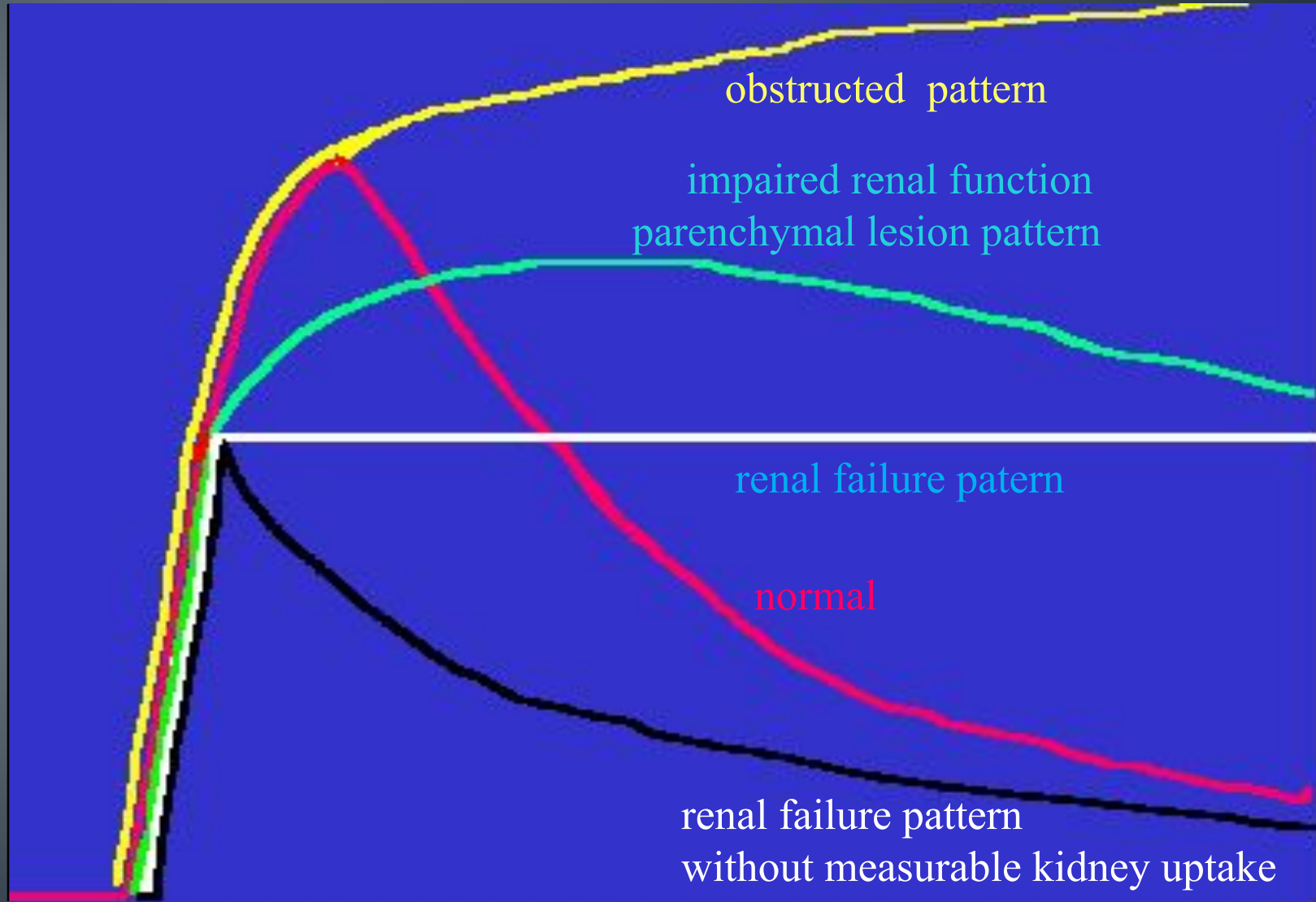
# Normal renogram curve

A



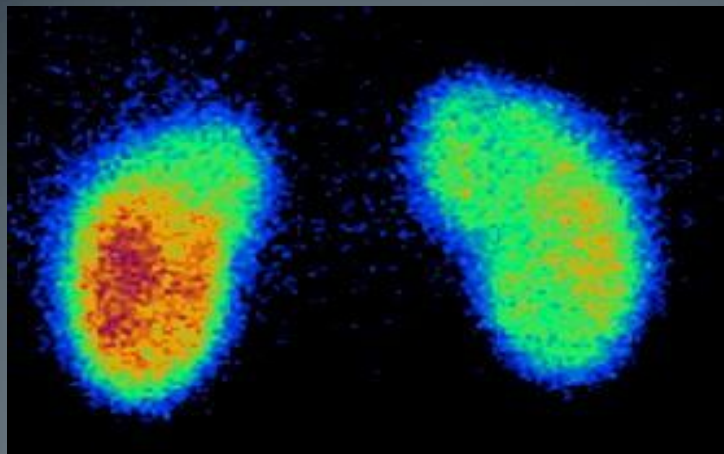
# Patterns of renographic curves

A

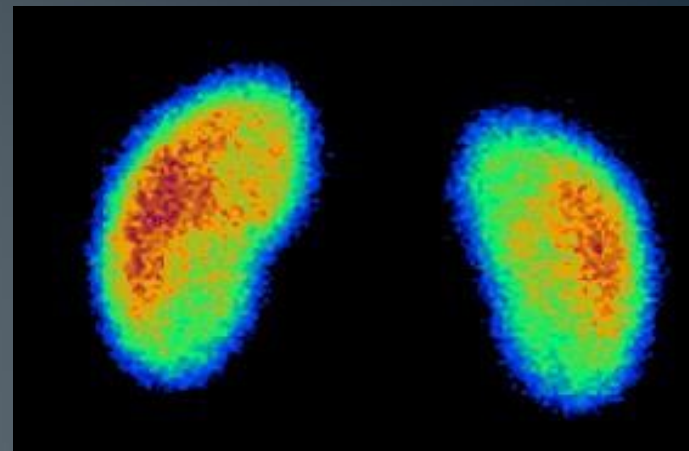


čas

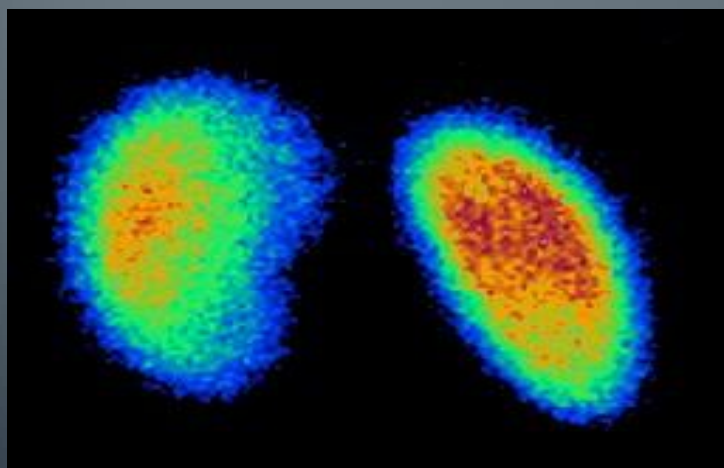
## Normal renal scan



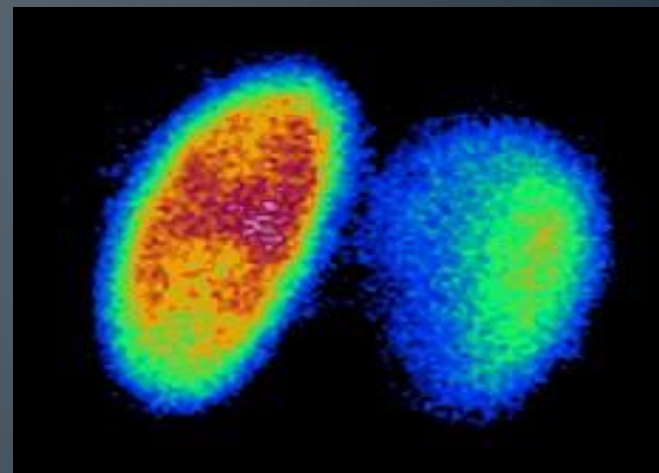
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POST



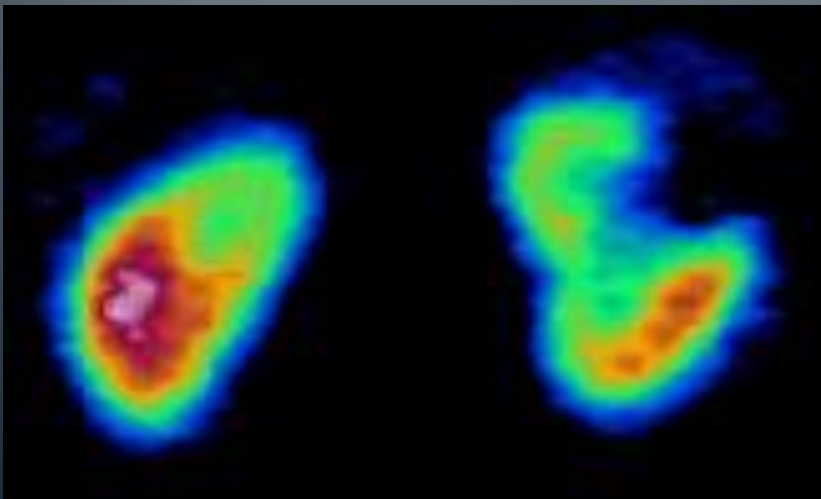
RPO



LPO

## Evaluation

- number of kidneys
- position
- size
- shape
- the size, number and location of areas cortical loss
- split renal function



### Note!

Cortical „cold“ defect may be due to different etiology :

tumor, abscess, cysts ....

already is necessary to compare with US

Thank You!!!!