Kazan State Medical University

topic :radionuclide examination of urinary tract

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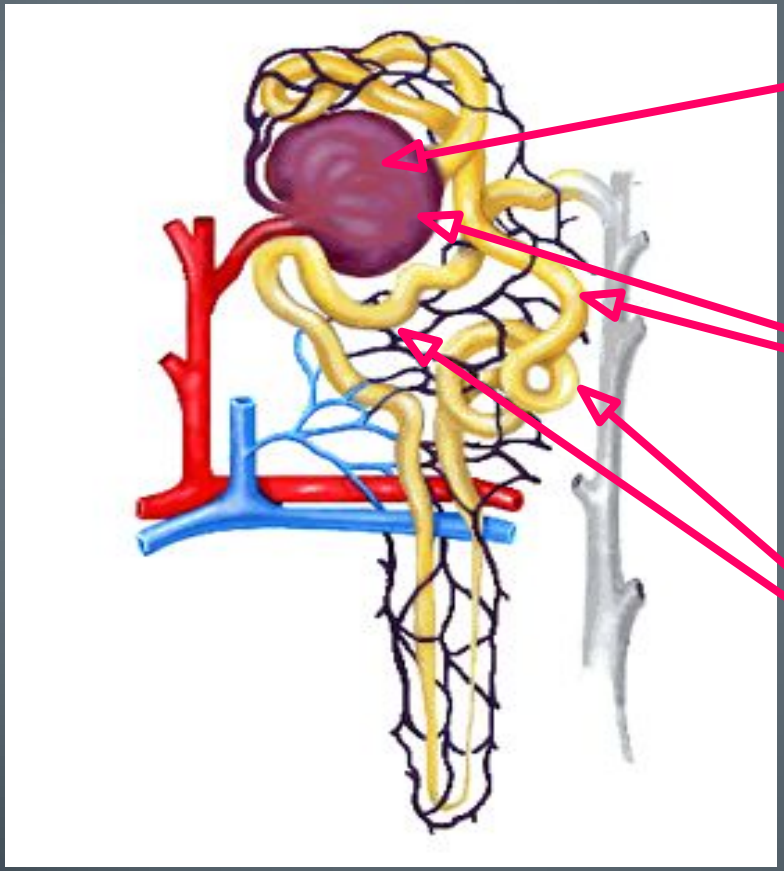
Group 1317

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}Tc DTPA**

Tubular secretion

- **^{99m}Tc MAG3**
- ^{131}I, ^{123}I – OIH

Tubular fixation

- **^{99m}Tc DMSA**
- ^{99m}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.

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

Radiopharmaceticals

99mTc-DTPA – Diethylentriamine 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 measuringglomerular filtration (GFR)
and good imaging of renal parenchyma

Vižďa J. a kol : Atlas of Renal Scintigraphy, 2002.

Radiopharmaceticals

99mTc-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

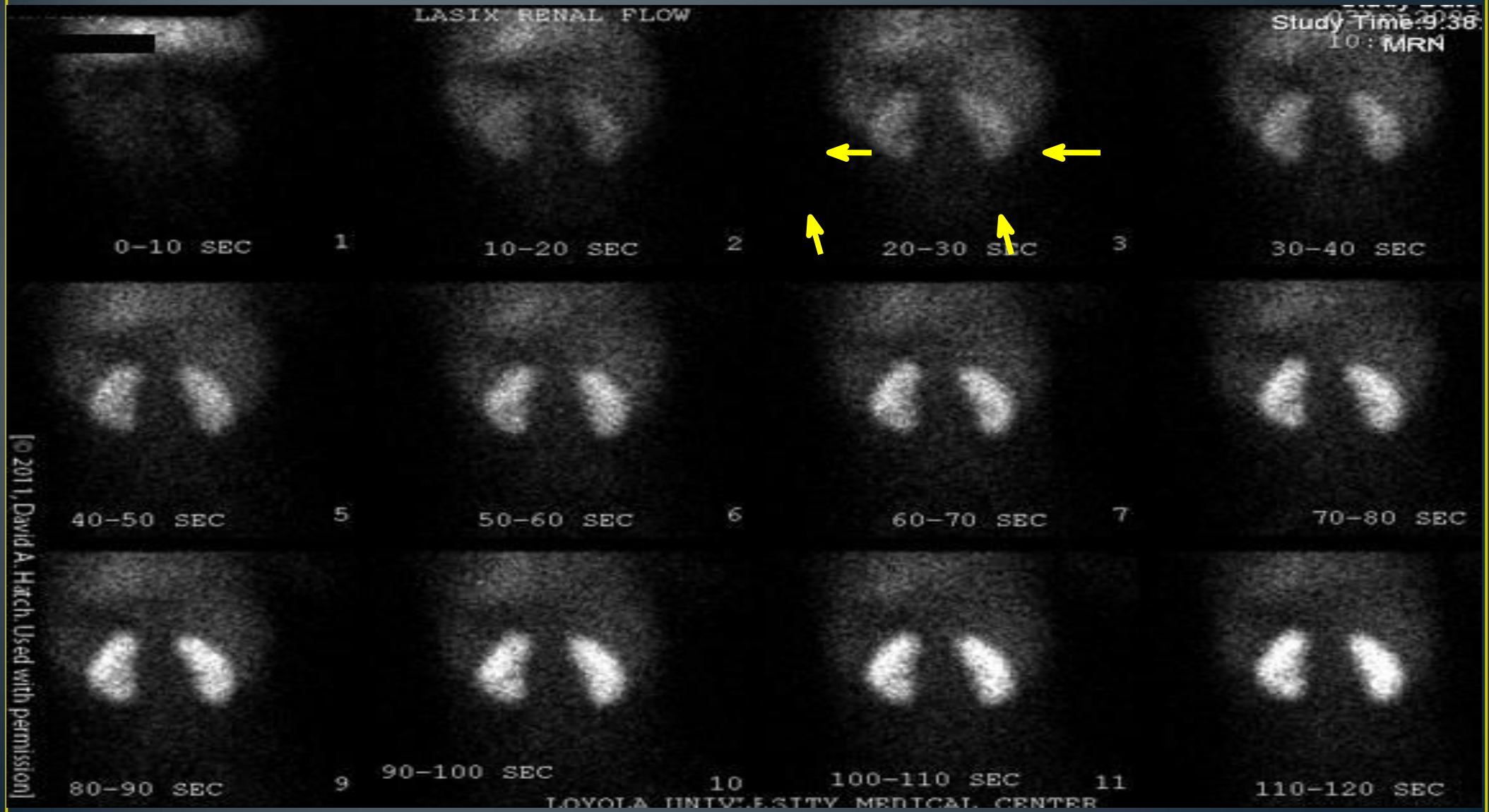
adequately hydration prior to the examination

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

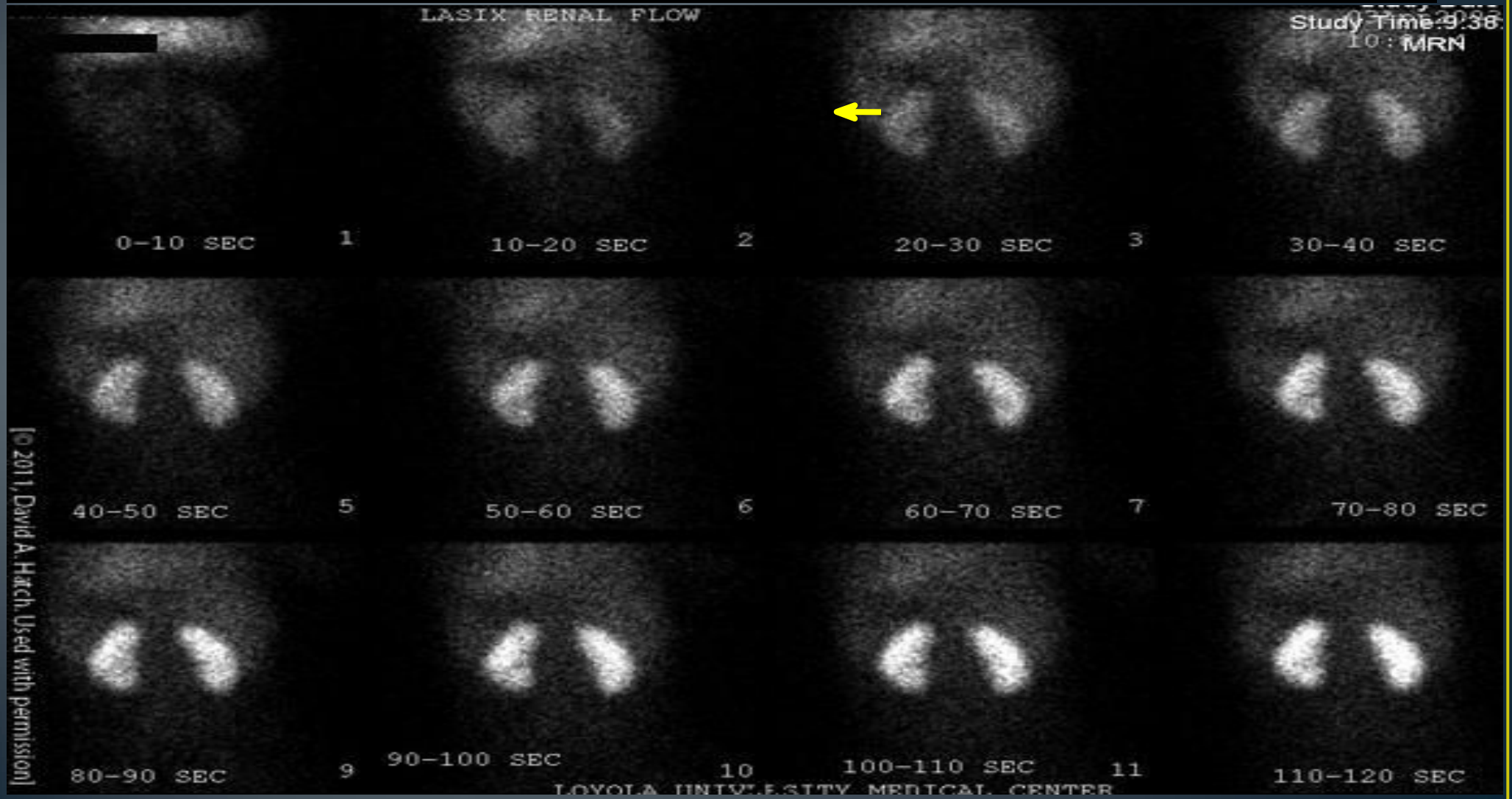
empty bladder

p.are requested to void completely prior to the study

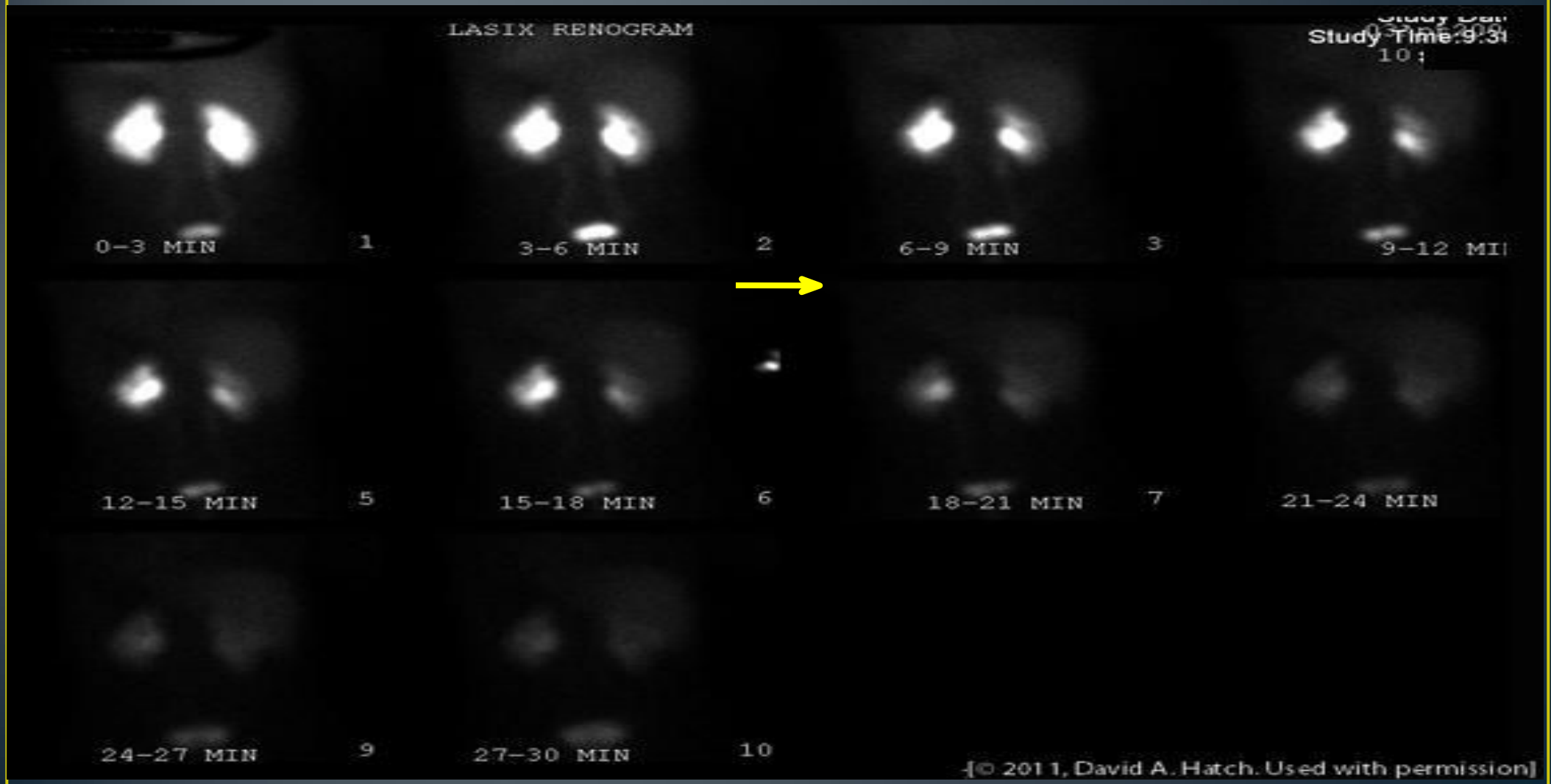
Perfusion Panel



Perfusion Panel

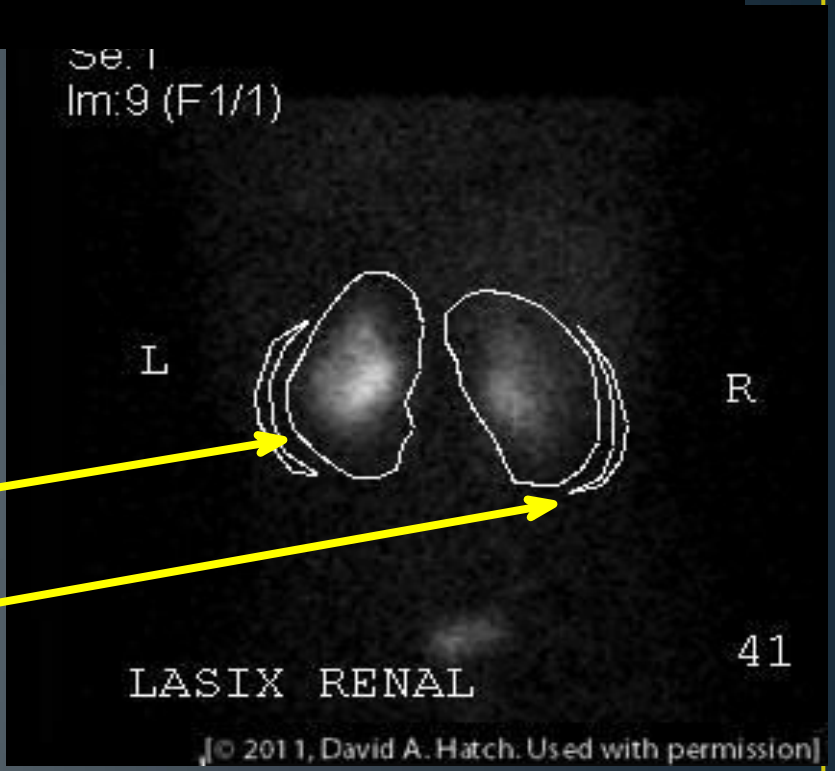


Excretion / Drainage Panel



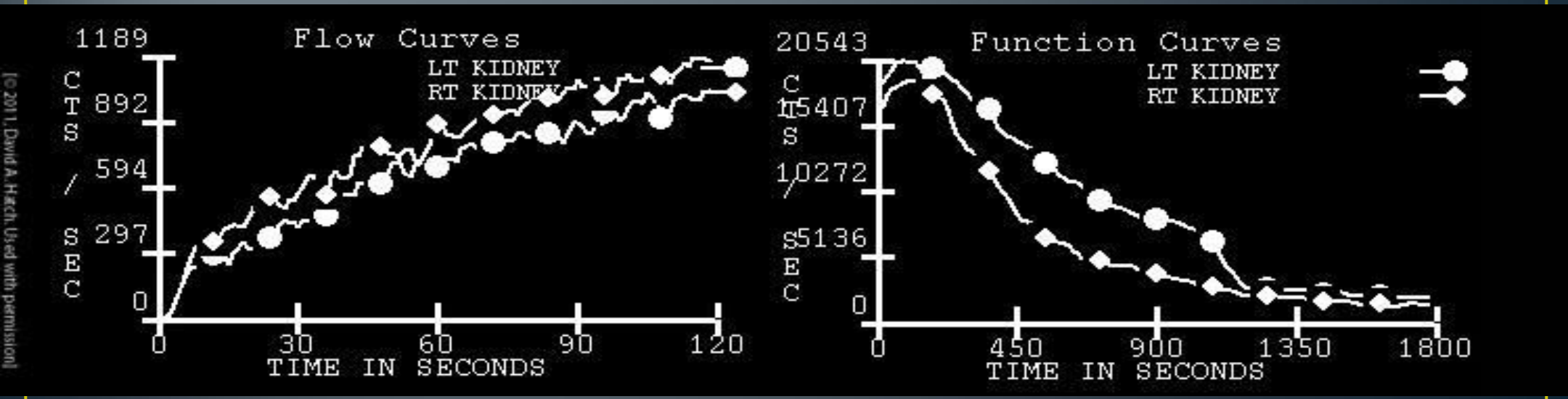
Curves / Analysis Panel

- 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.

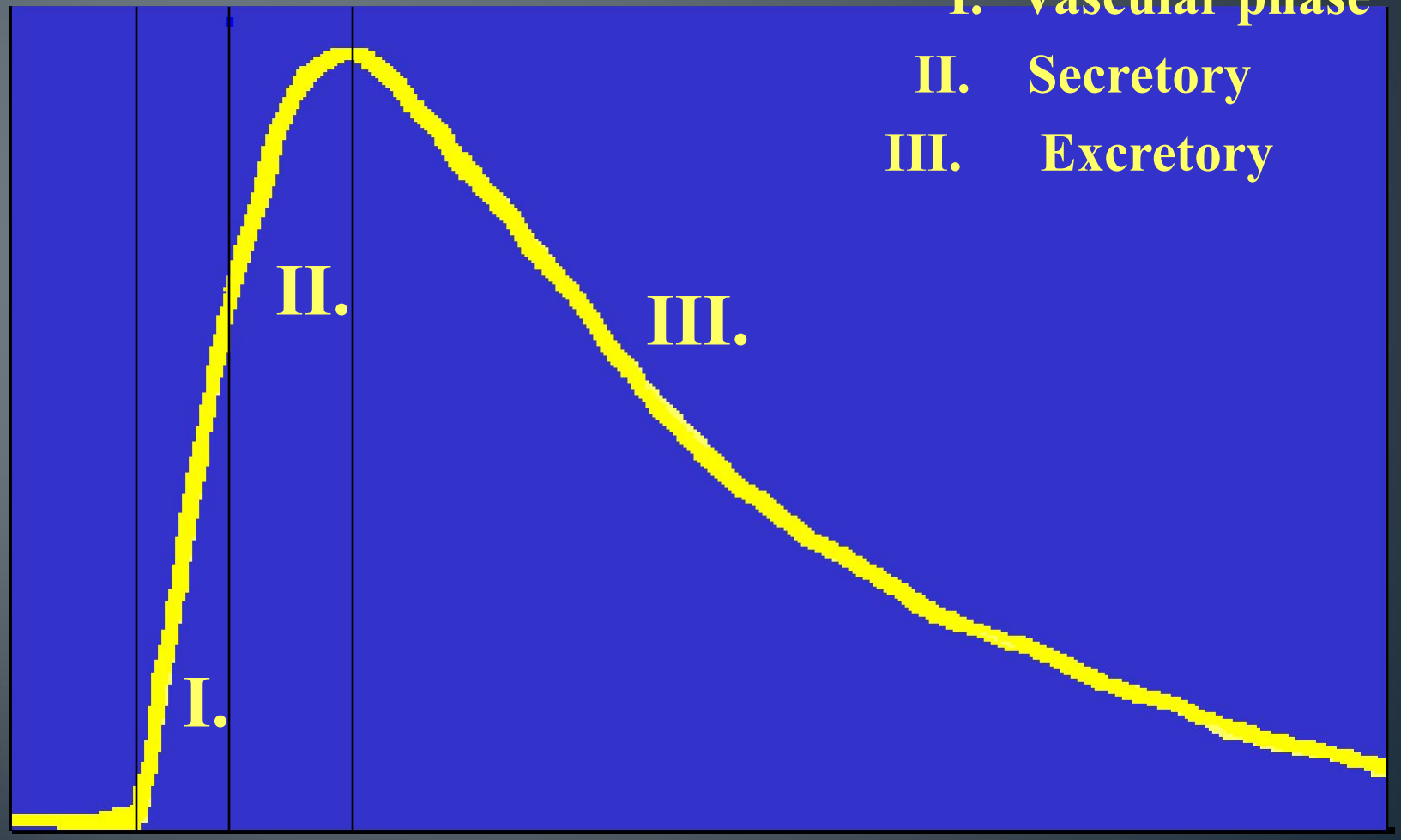


Look at some normal curves.

- 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.

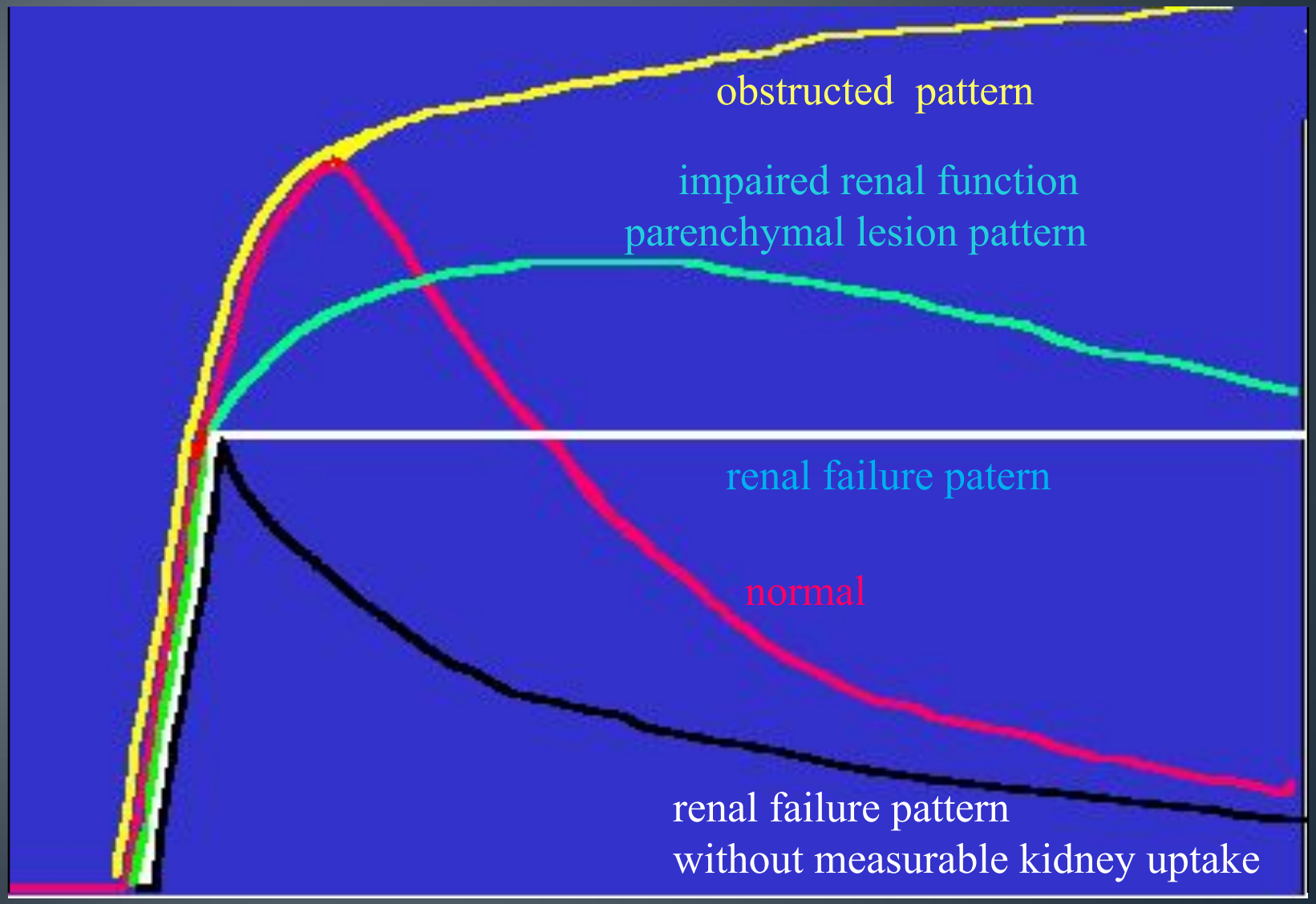


Normal renogram curve

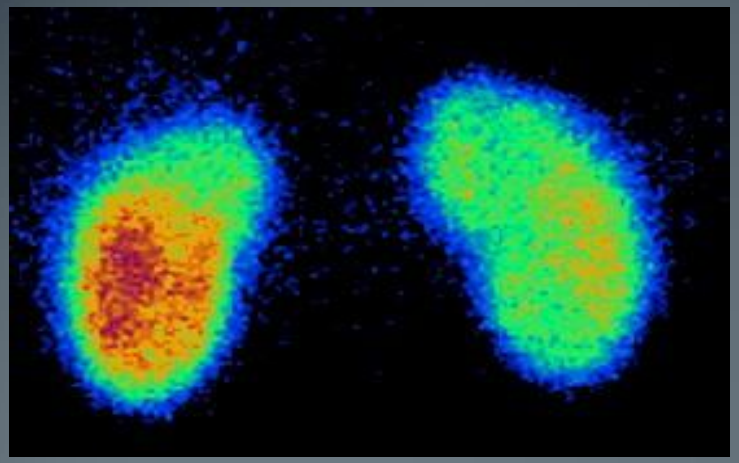


I. Vascular phase
II. Secretory
III. Excretory

Patterns of renographic curves



Normal renal scan



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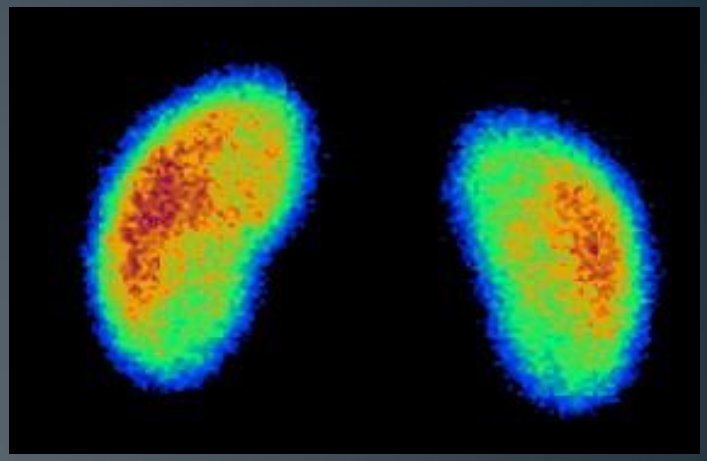

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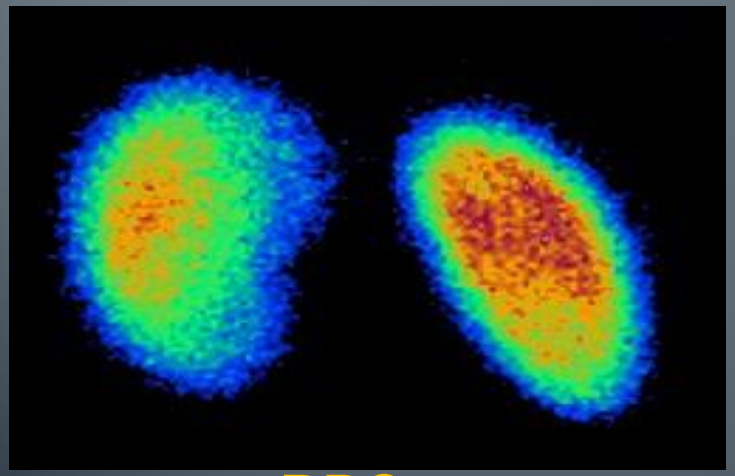
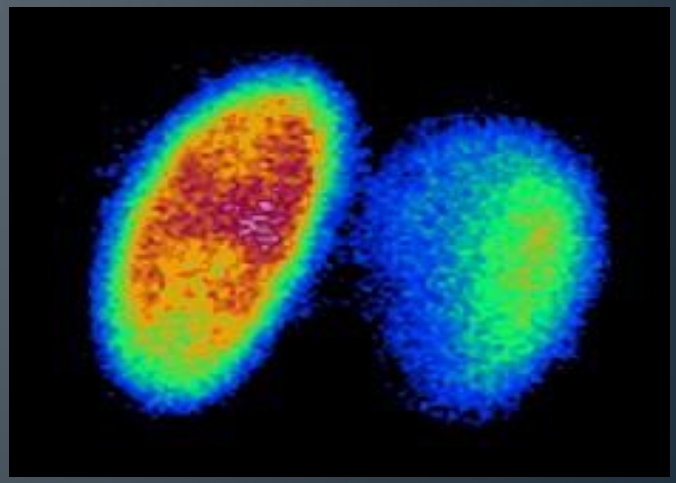


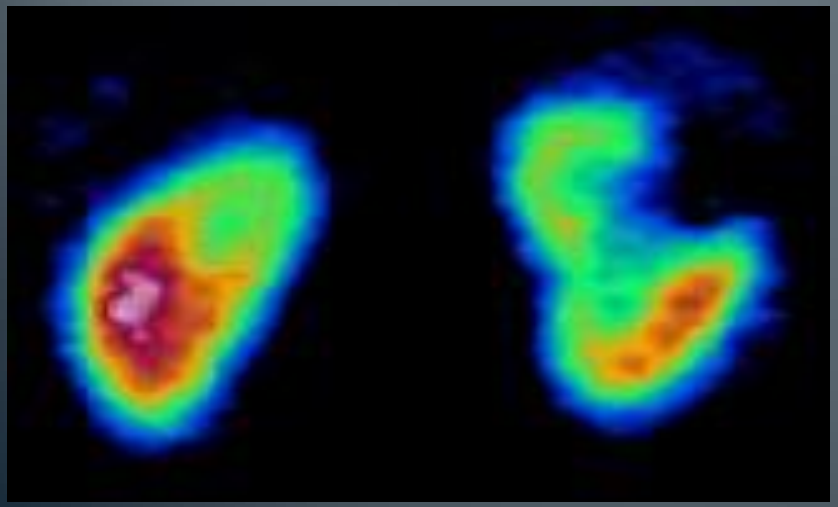
RPO



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 ….

alrealdy is necesarry to compare with US

Thank You!!!!