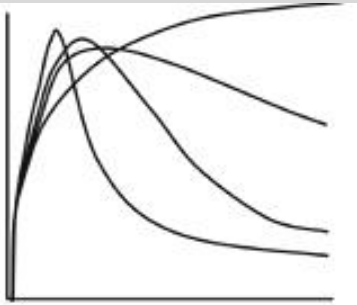




What does Nuclear medicine contribute to Nephrourology?



Katharine Halliday
Queen's Medical Centre





Questions

- Function?
- Pyelonephritis?
- Scarring?
- Reflux?
- Obstruction?
- Is the transplant perfused?



DMSA

- ^{99}Tc -Dimercaptosuccinic acid
- Cortical imaging agent
- ~40% retained by renal tubules
- Protein bound, filtered by glomerulus
proximal tubule mediated endocytosis
- Depends on blood flow, GFR, endocytosis
- Image at 2-4 hours, no sedation necessary



LEFT PINHOLE



LPO PINHOLE



RIGHT PINHOLE

IMSA RENAL SCAN



LPO PINHOLE



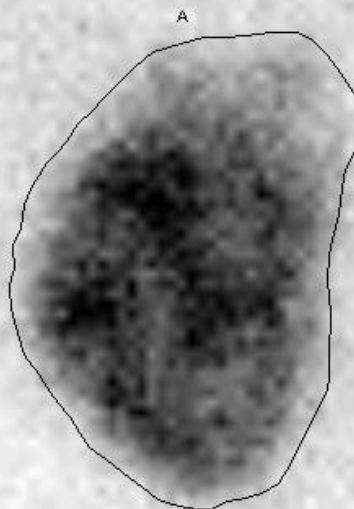
POST FLUAS

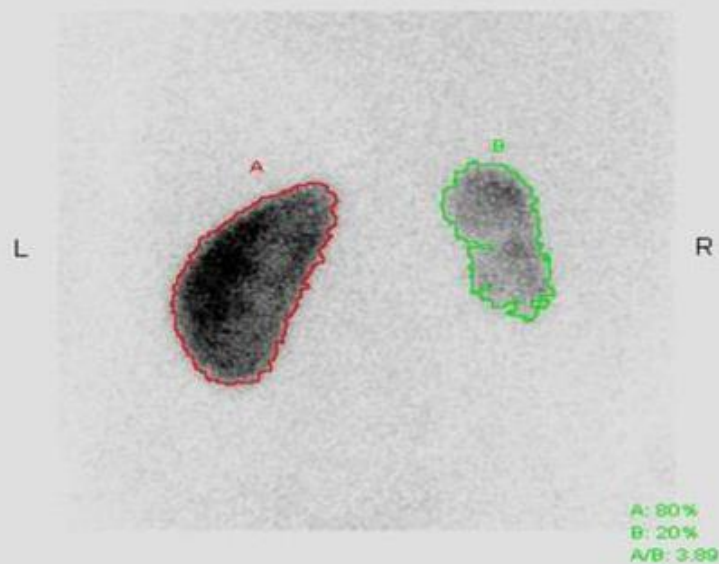


Function

LT KIDNEY = 55624
50.3 %

RT KIDNEY = 54935
49.7%





Posterior

%

75

0

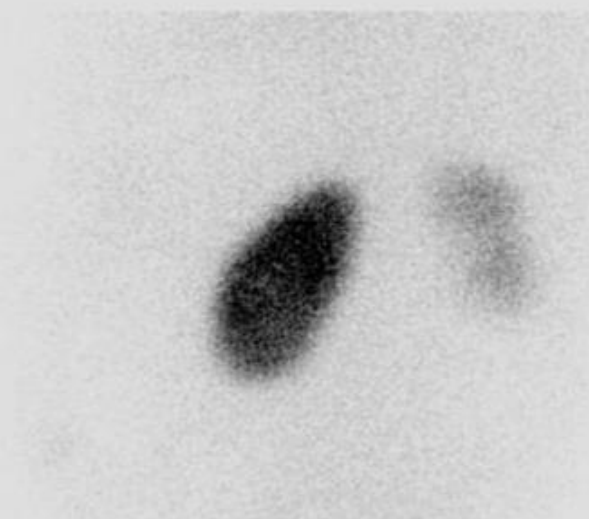
Renal

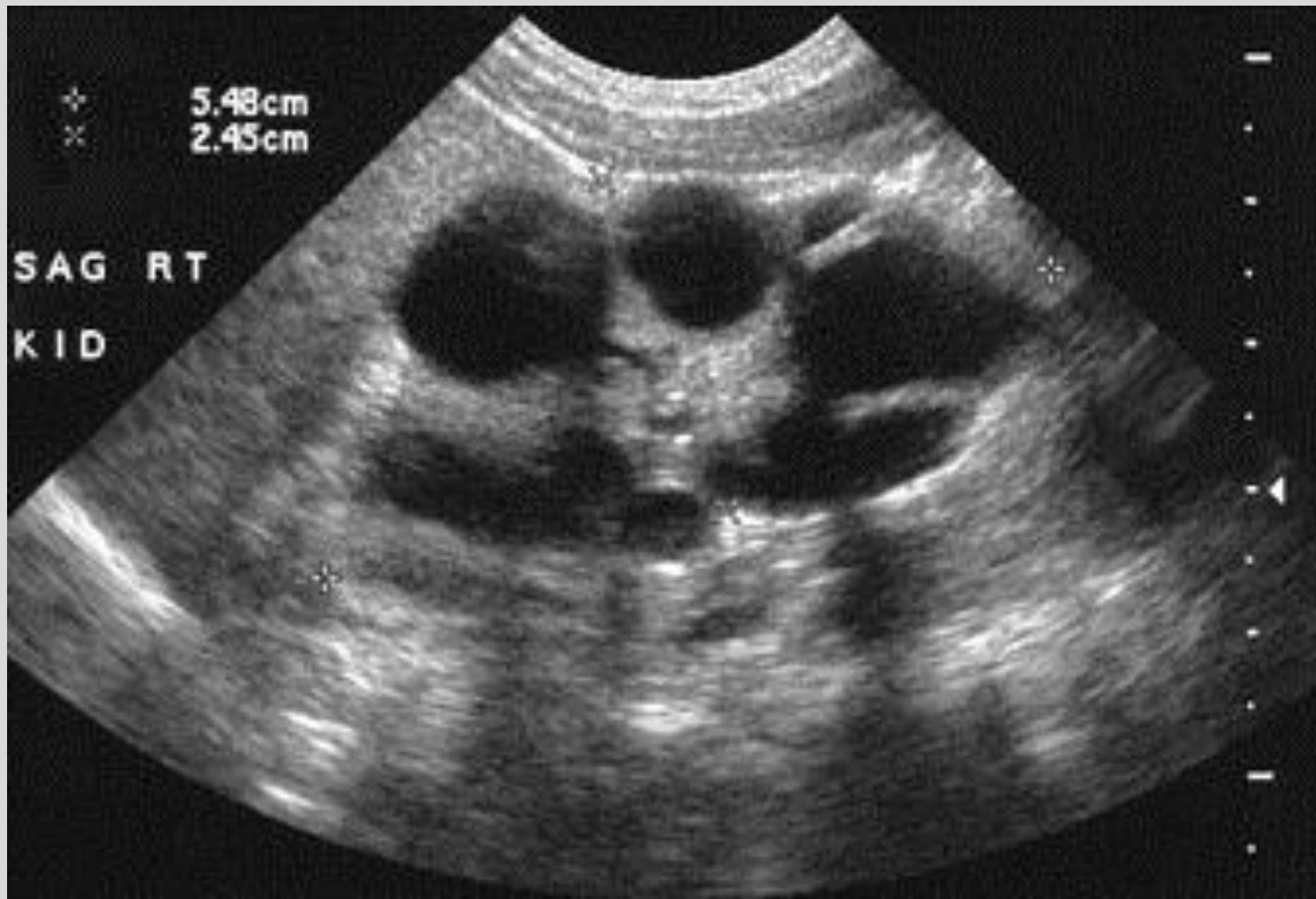
%

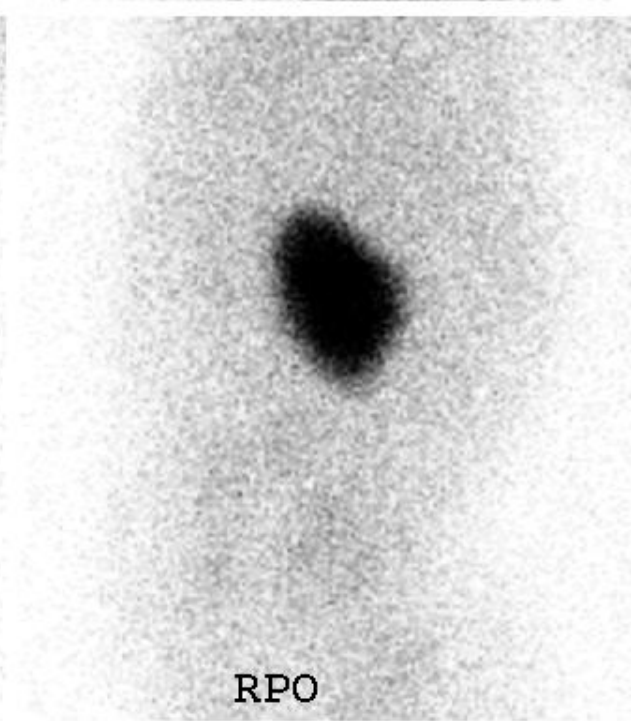
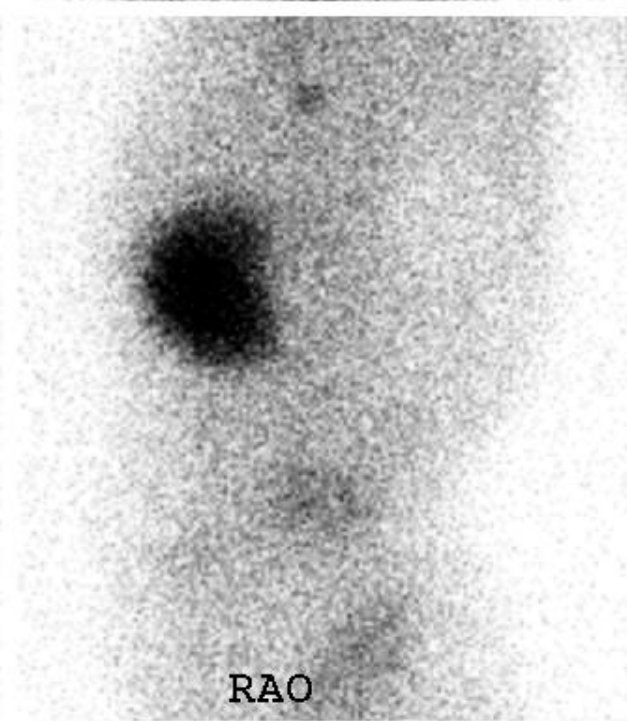
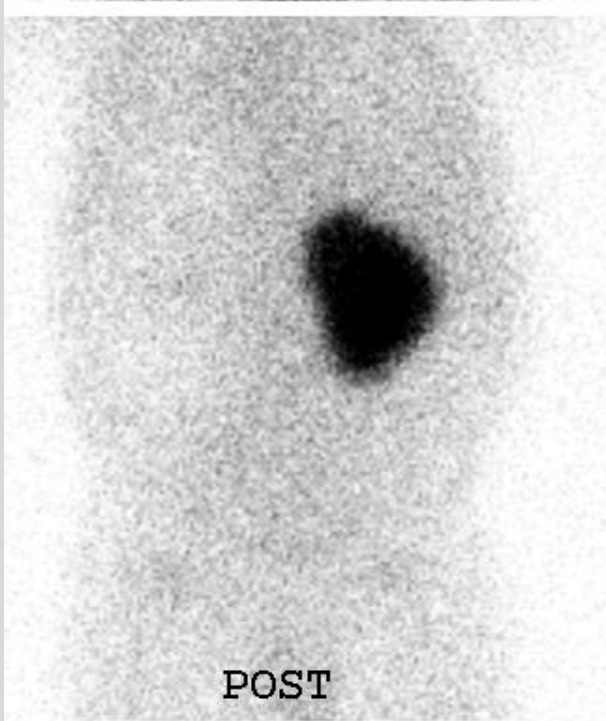
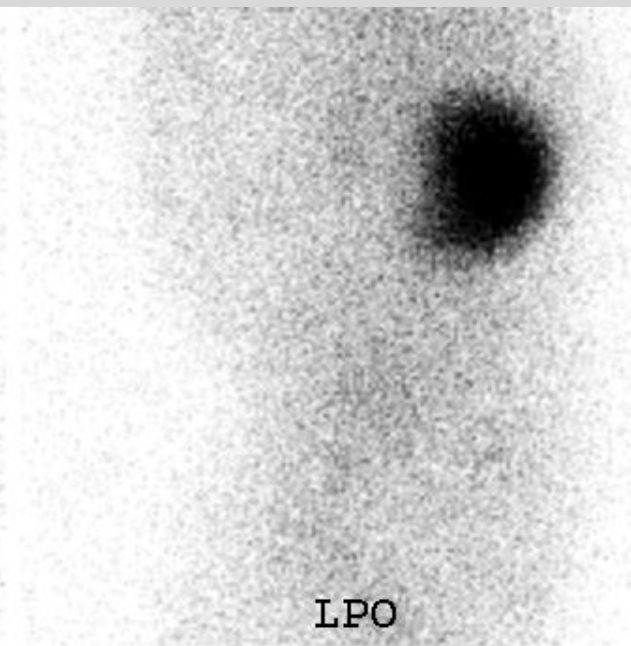
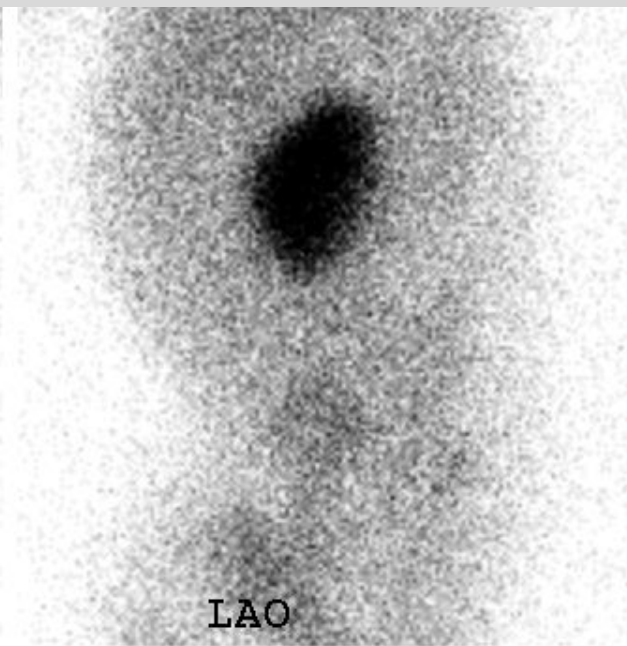
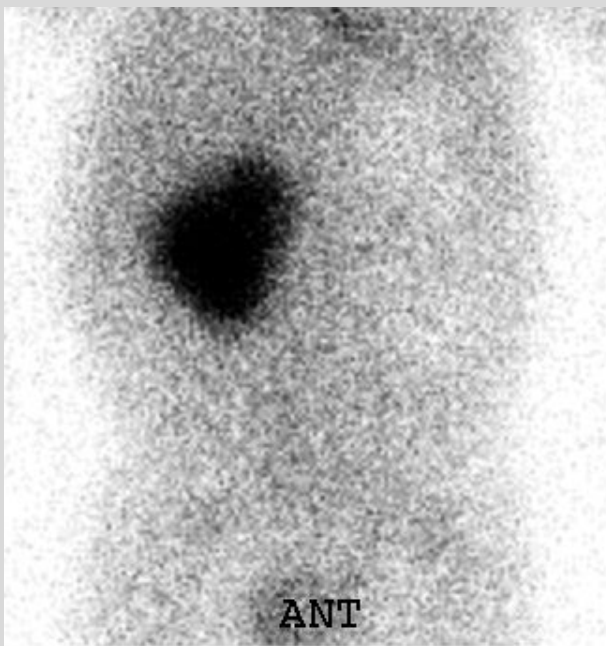
75

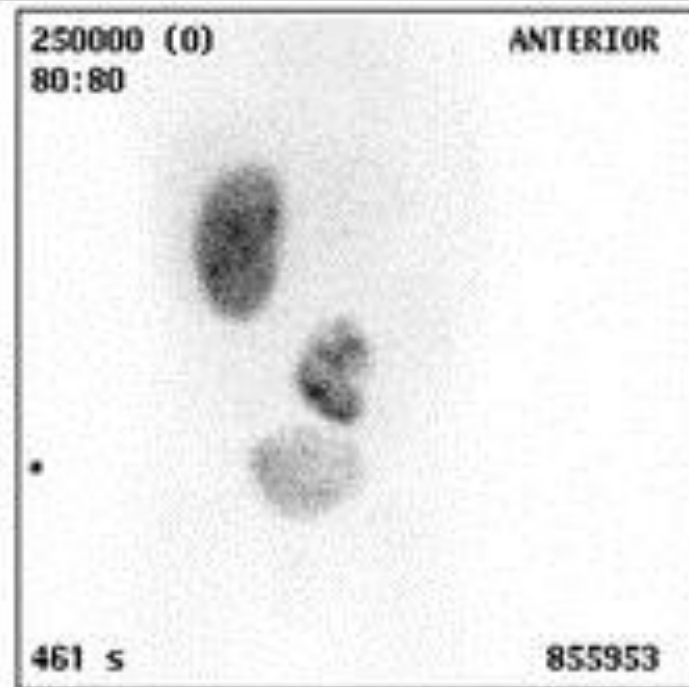
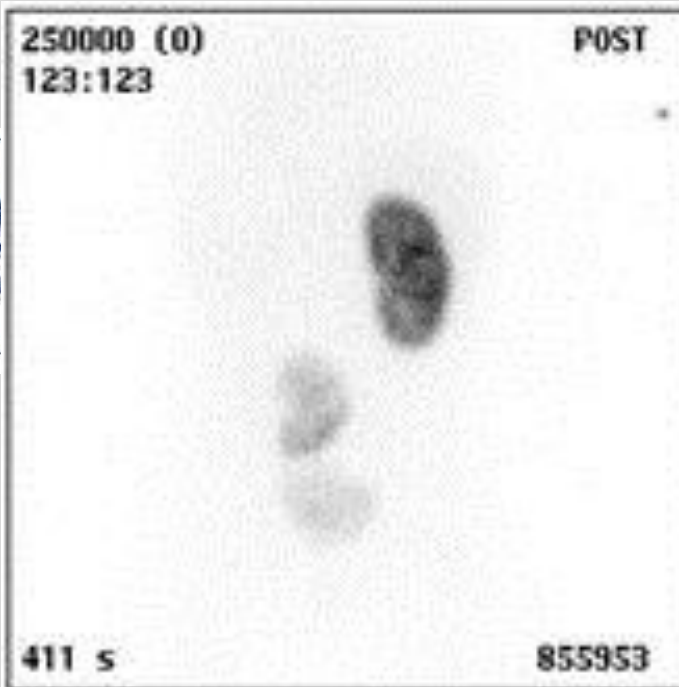


Posterior

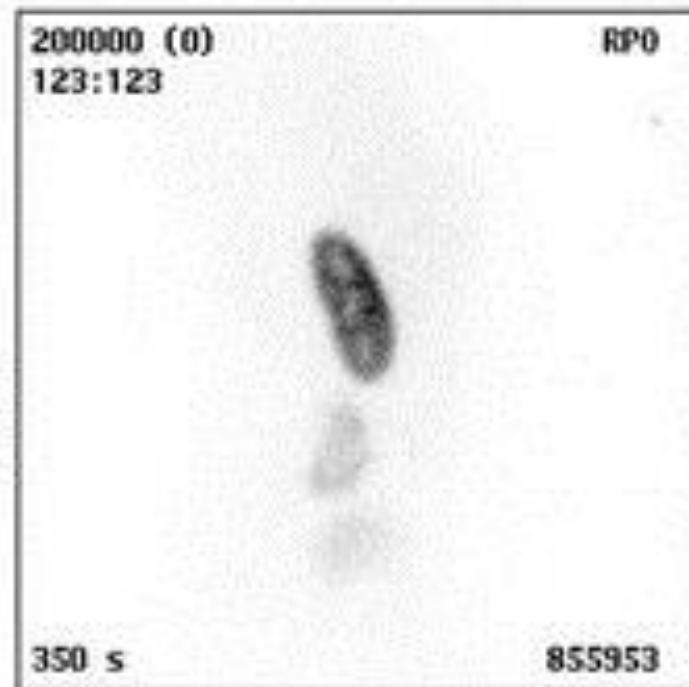
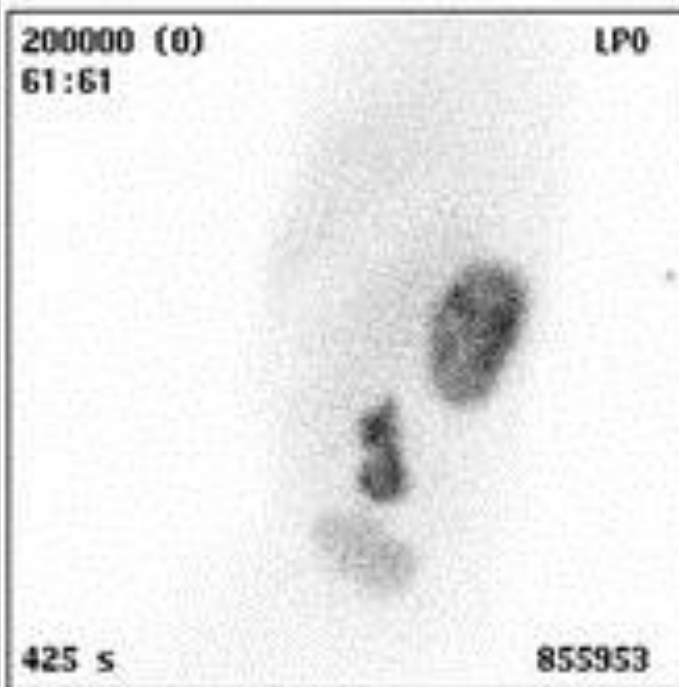








R
i
g
h
t



L
e
f
t



POST

Left

ANT

Right

LPO

Left

RPO

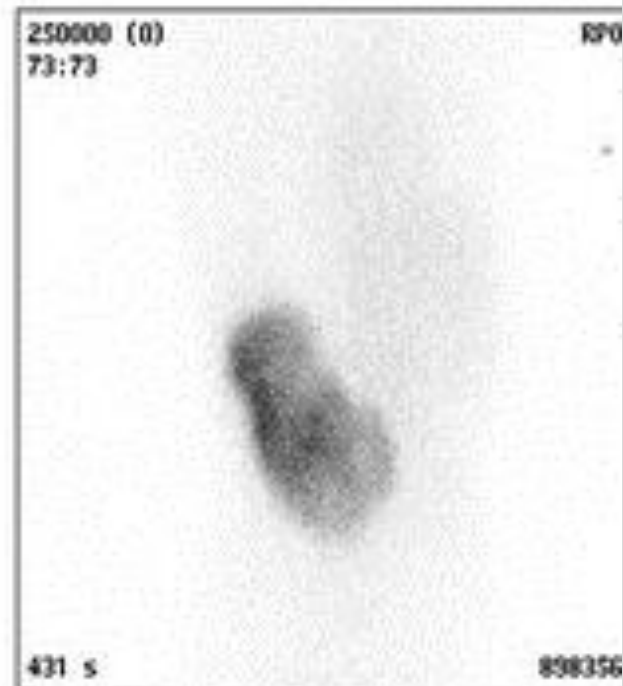
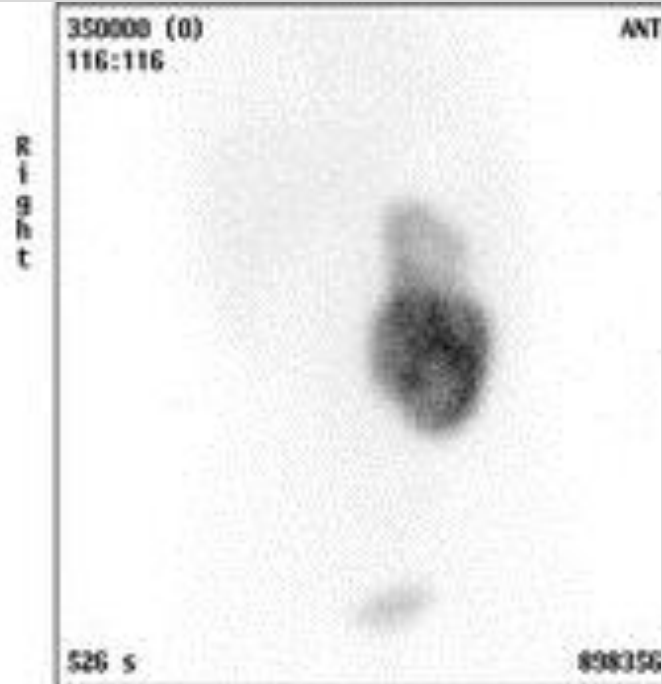
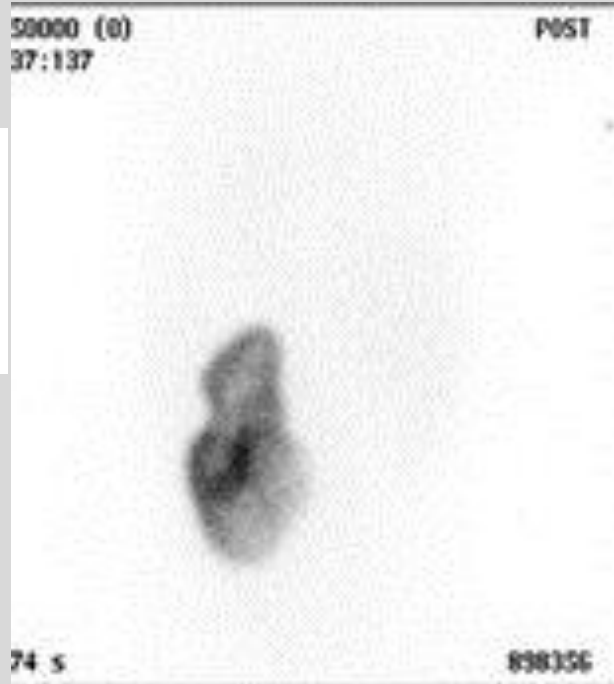
Left

LAO

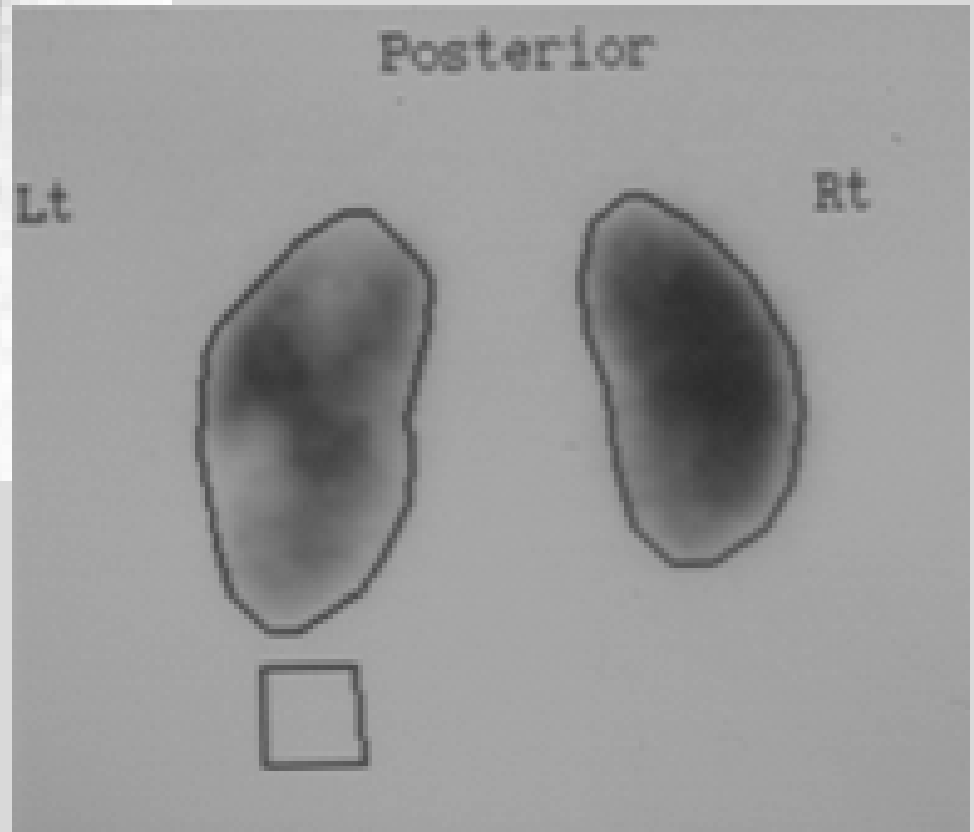
Right

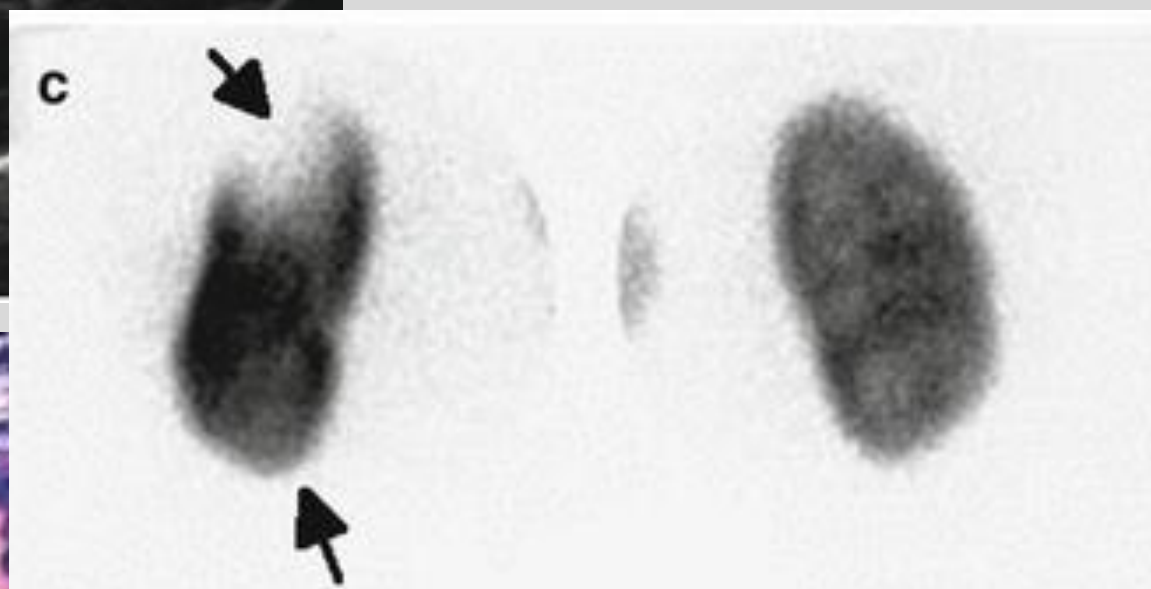
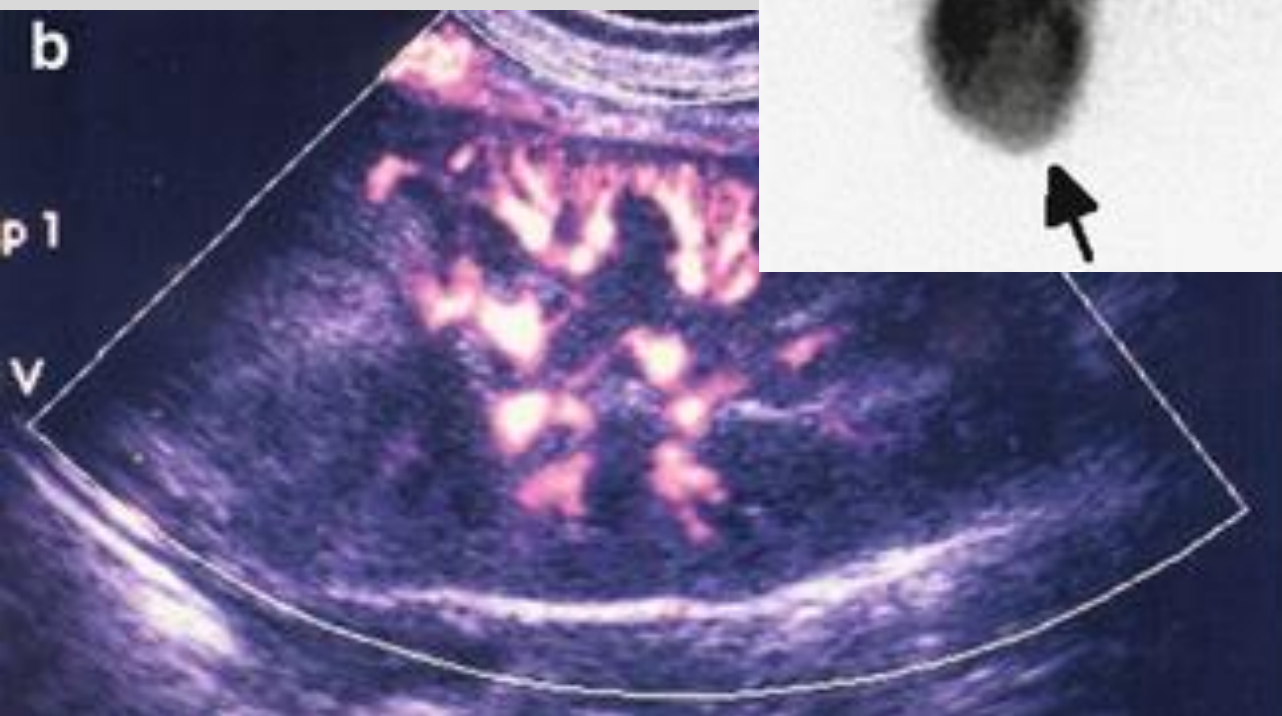
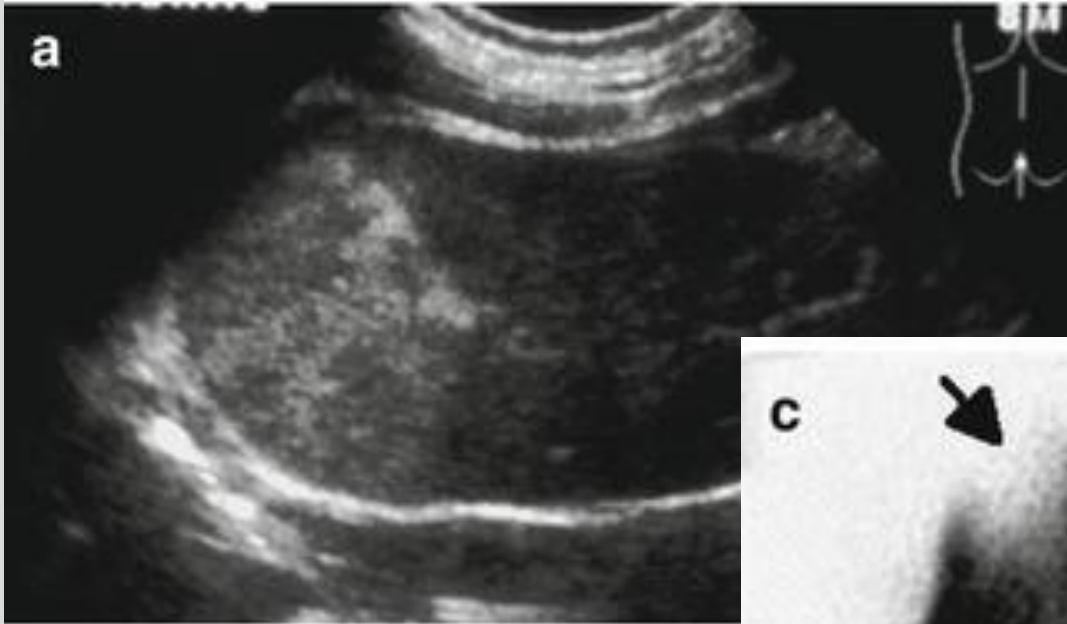
RAO

Right



Acute pyelonephritis







CT - Pyelonephritis

- As good as DMSA in piglets¹
- IV contrast
- Radiation dose

¹Majd Radiology 2001

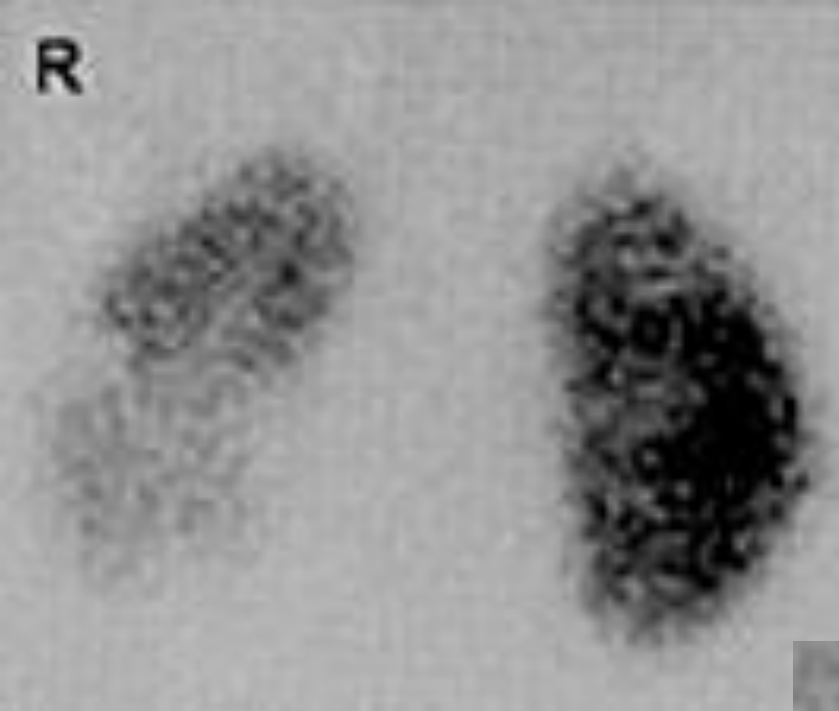




MRI - Pyelonephritis

- As good as DMSA (Gd enhanced)
- No radiation
- Sedation/GA

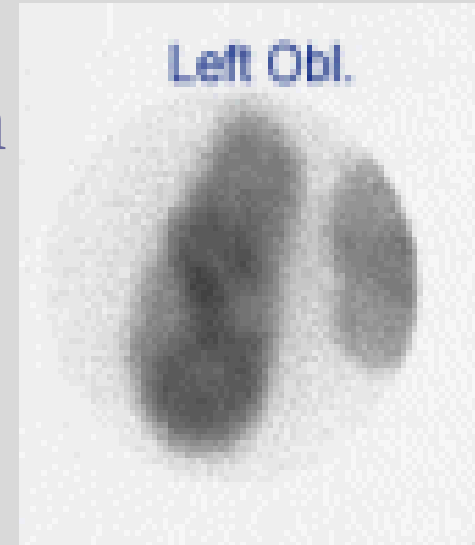


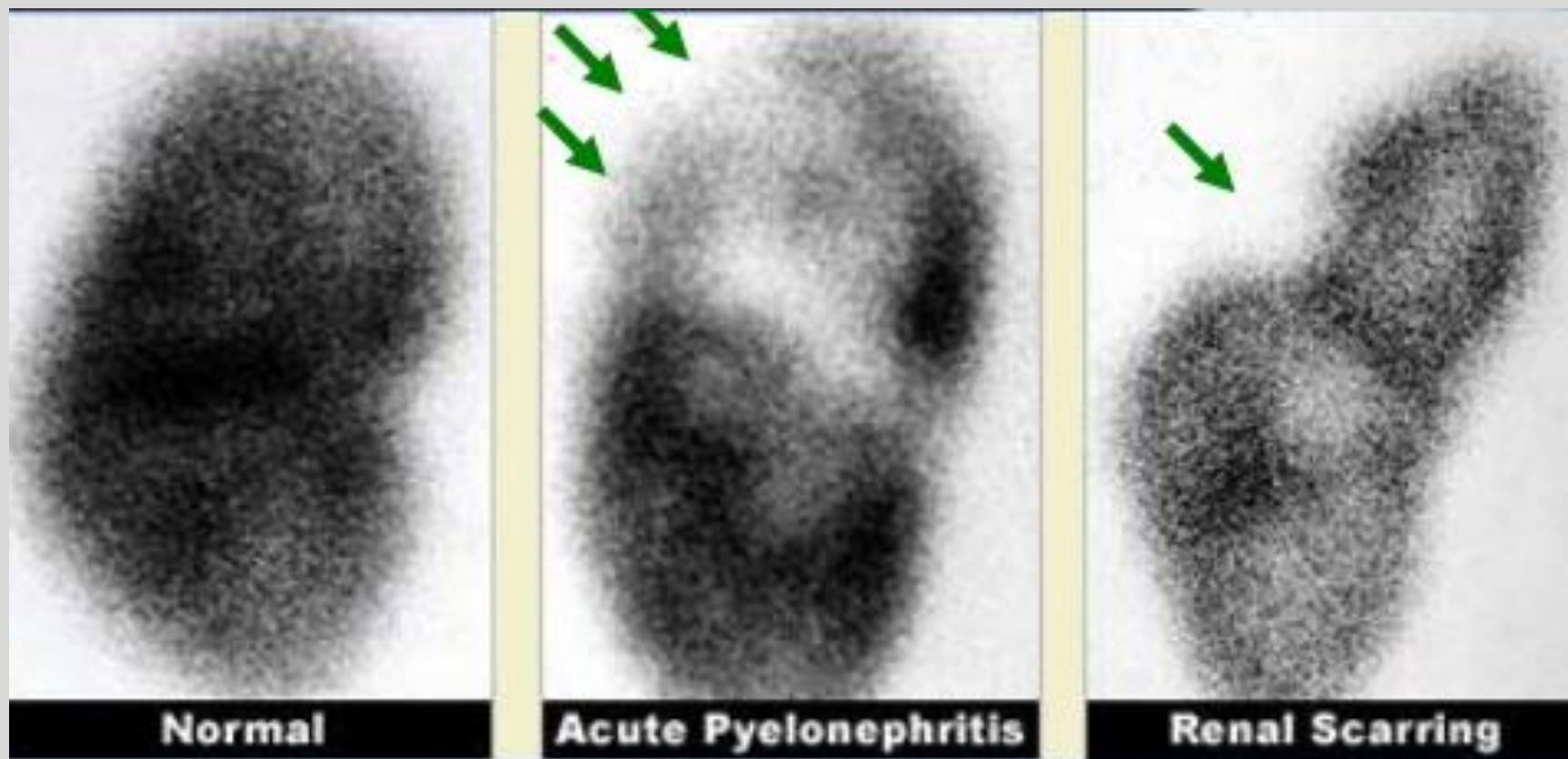




Pyelonephritis and Scars

- Permanent defects only develop in abnormal areas on the acute scan
- Approx 50% defects remain
- No need to follow up isolated lower tract infections





Normal

Acute Pyelonephritis

Renal Scarring

PA



AP



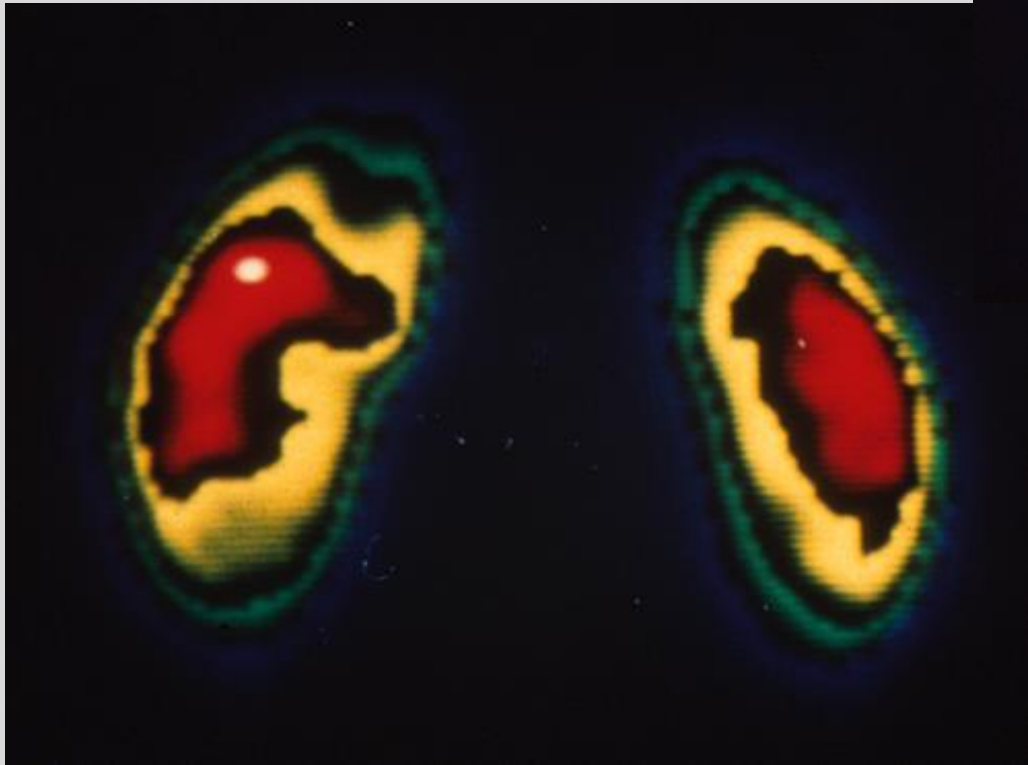
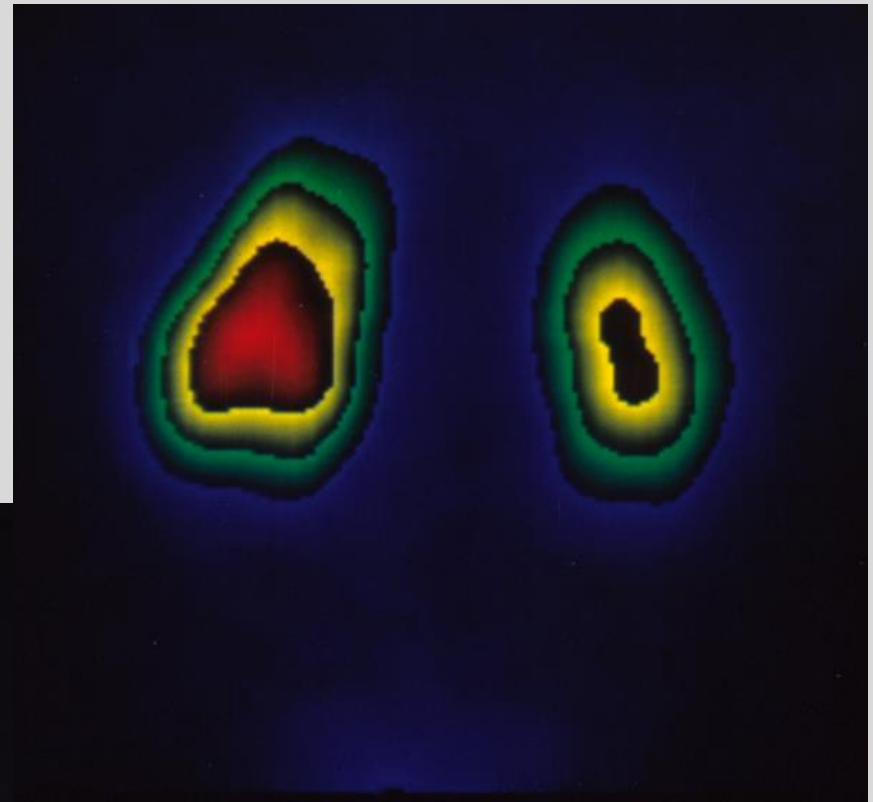
OPD



OPI



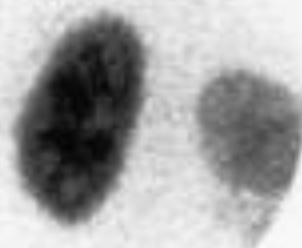
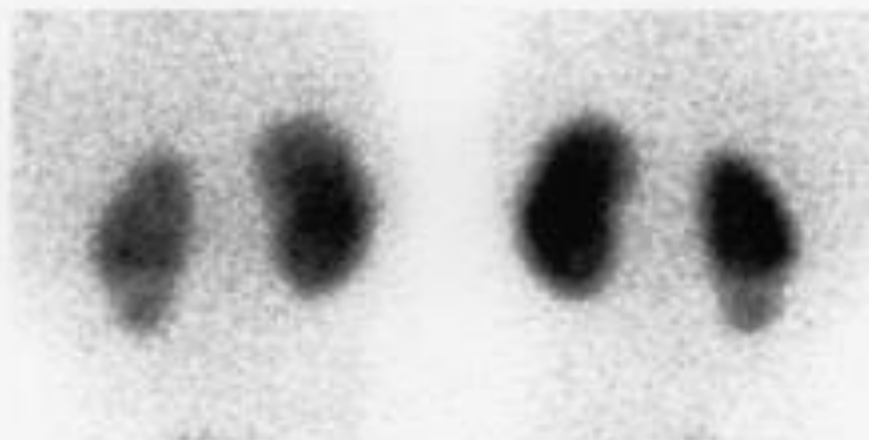
Nottingham
Paediatric
Radiology



PLANAR VIEWS

Anterior

Posterior



LPO



Left



Right



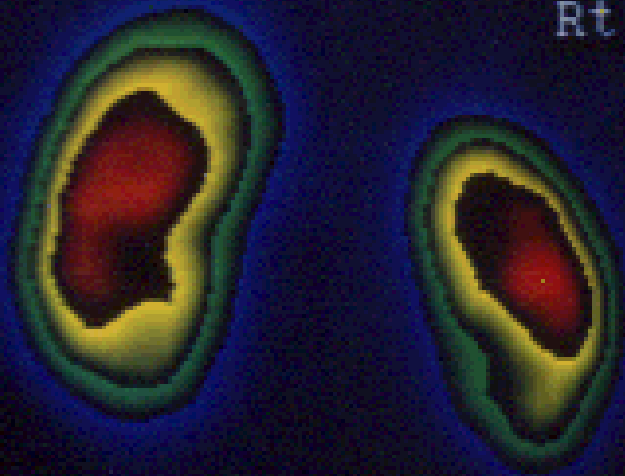
RPO

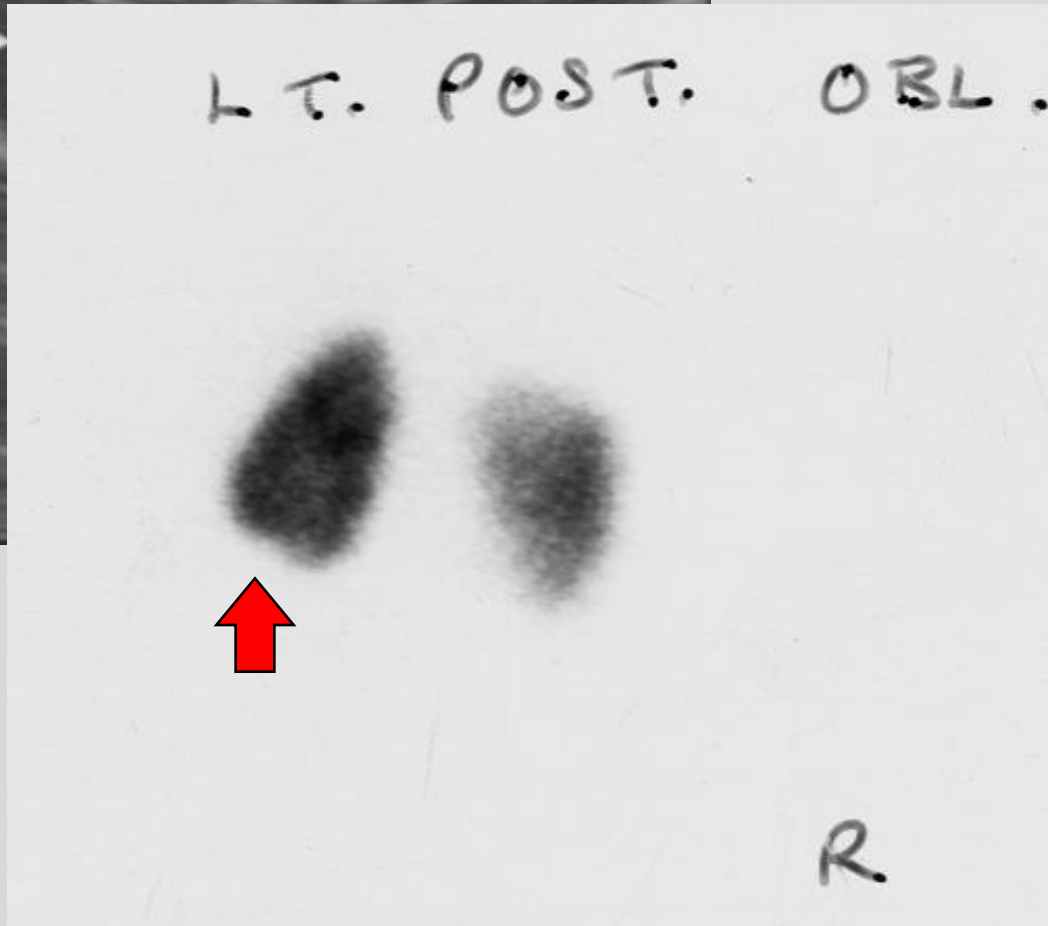
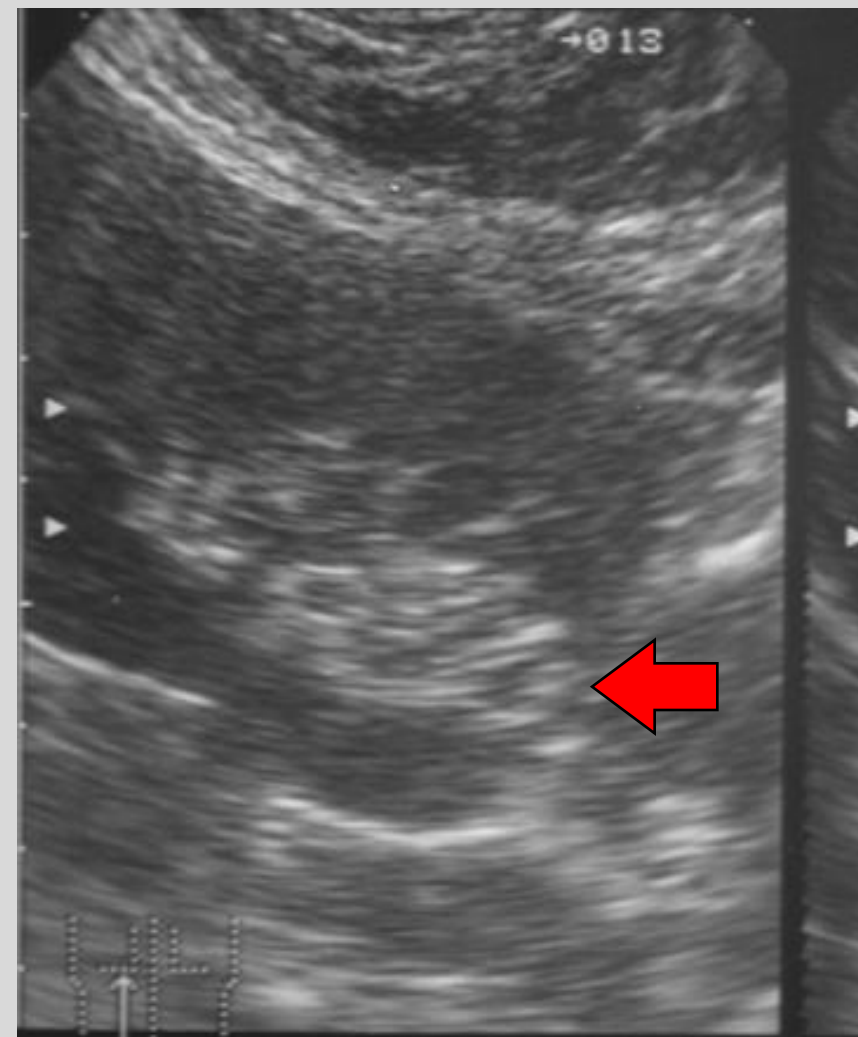
PINHOLE VIEWS

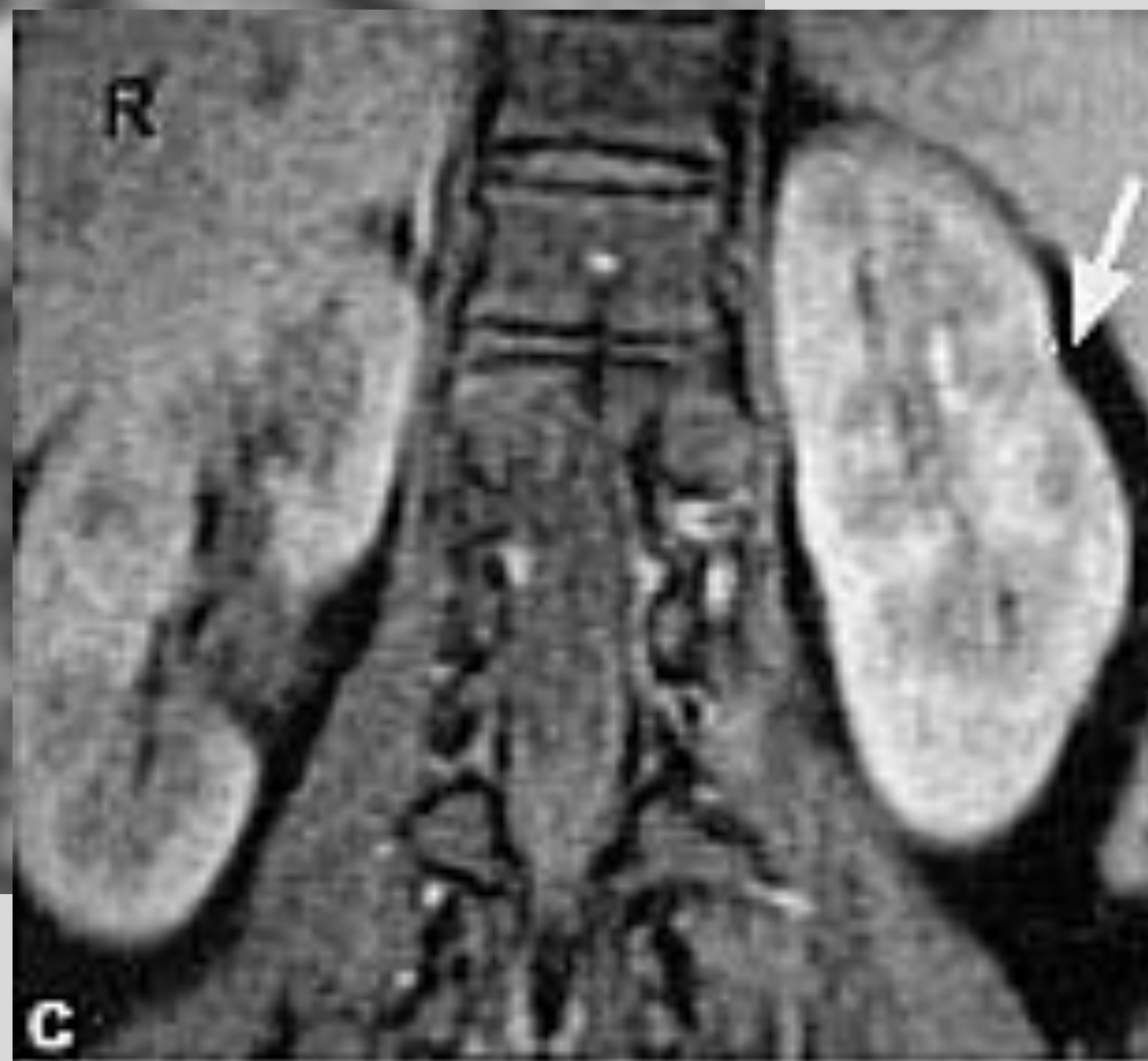
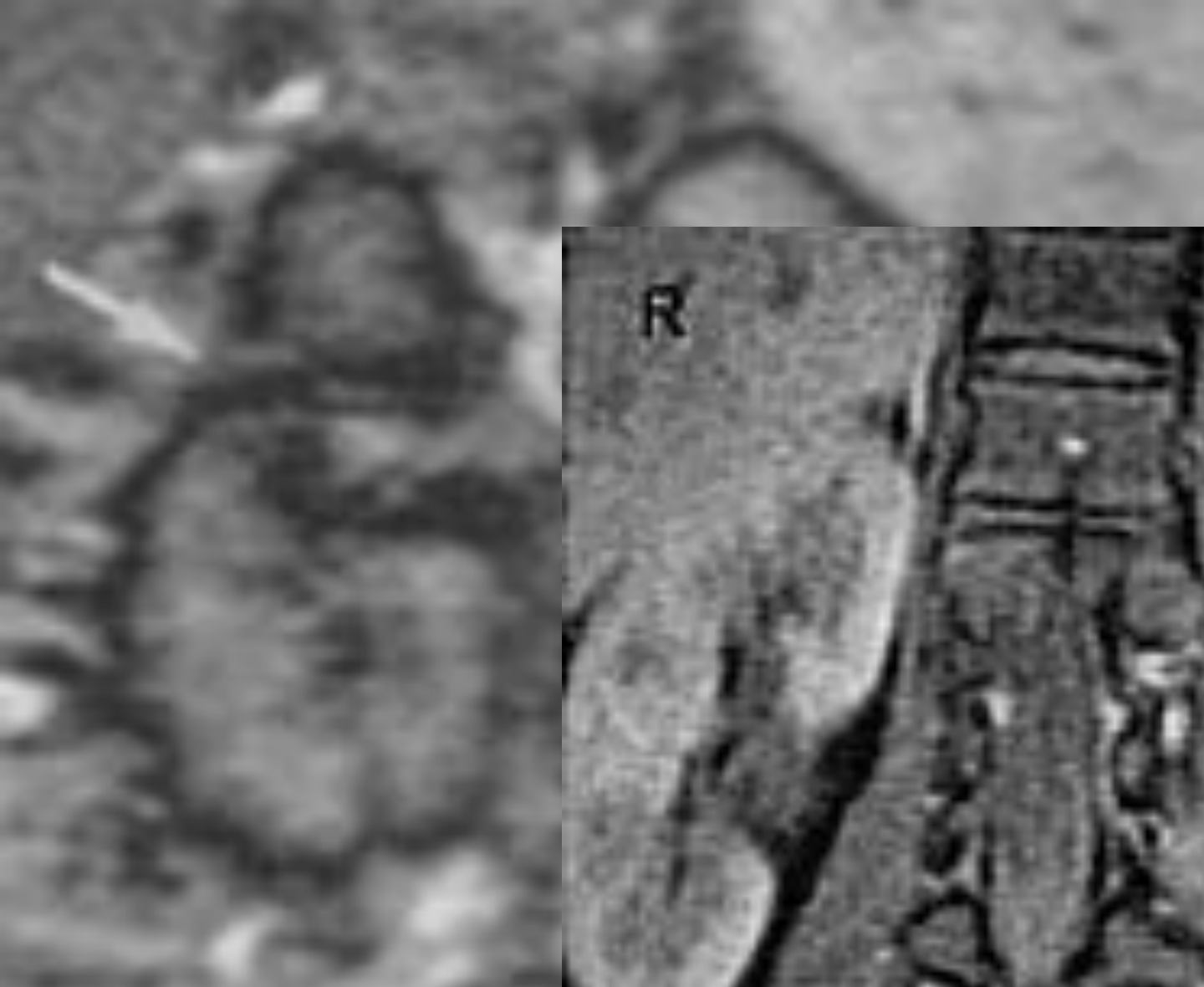
Posterior

Lt

Rt









Mag 3

- Mag 3 excreted by both filtration and tubular secretion
- 40-50% extraction
- Better images in babies and patients with poor renal function
- Wait until 3 months

2

3

4

5

6

L POST R

7'

8'

9'

10'

11'

12'

13'

14'

15'

16'

17'

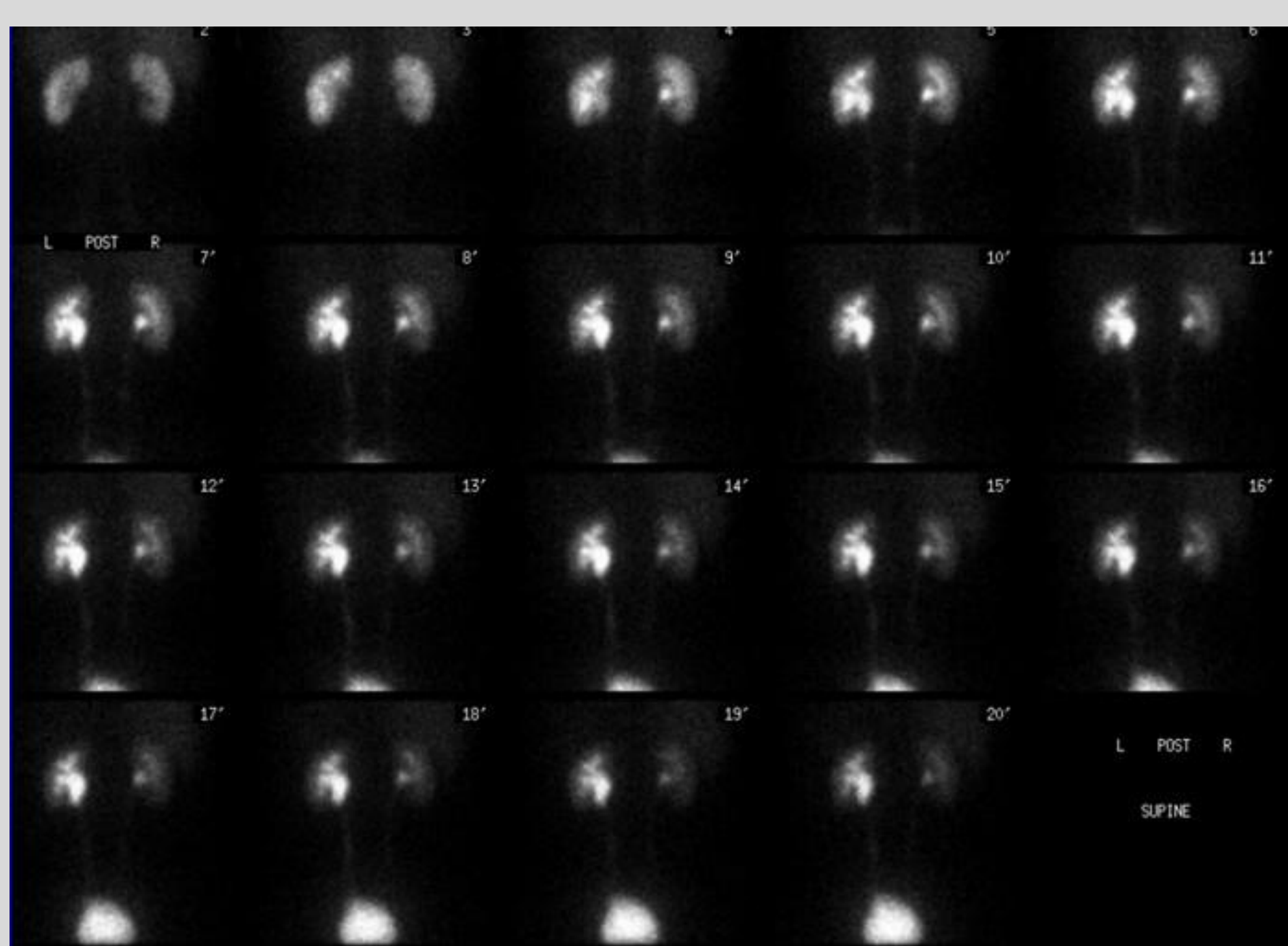
18'

19'

20'

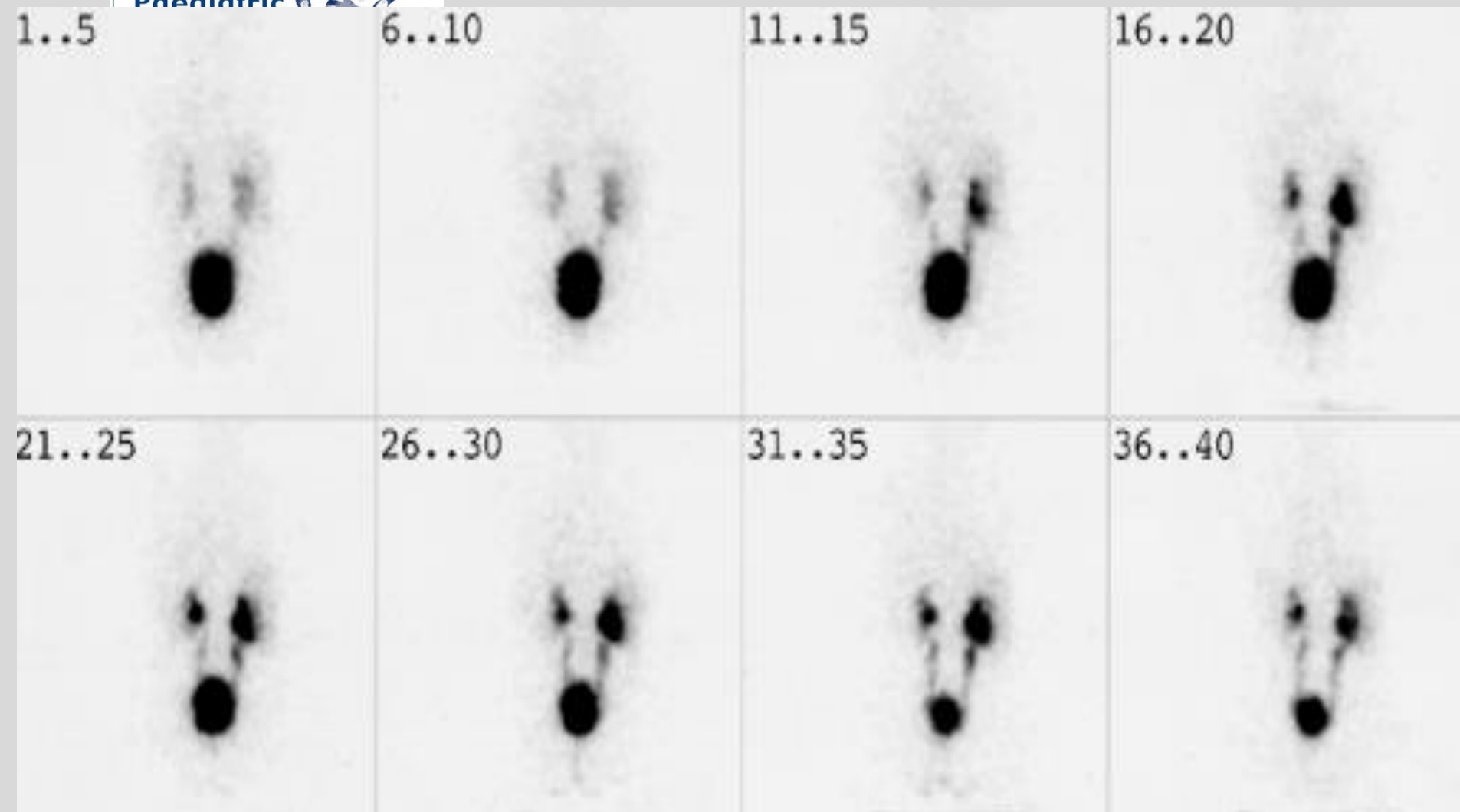
L POST R

SUPINE

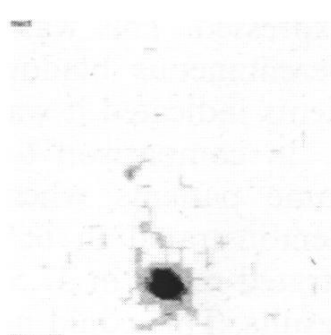
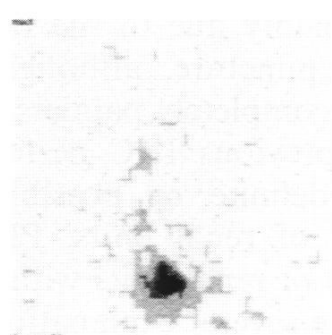
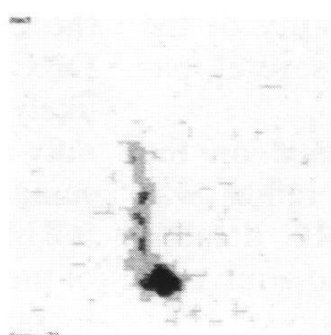
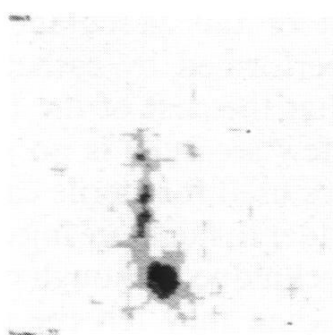
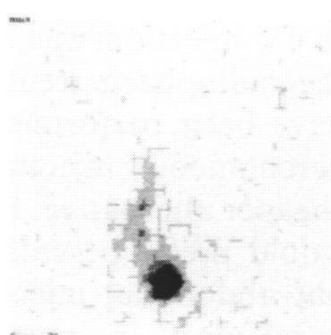
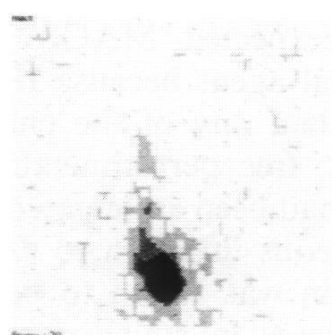
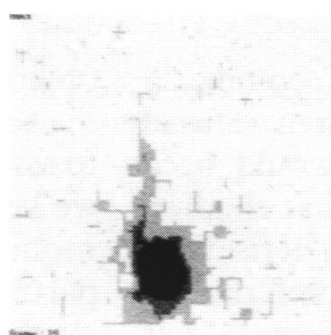
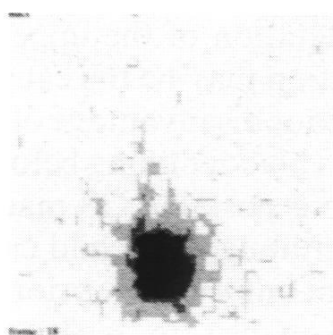
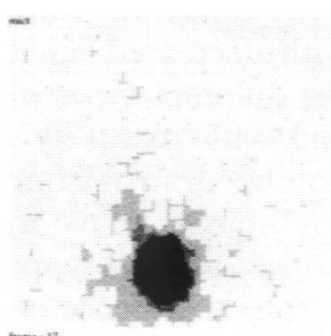
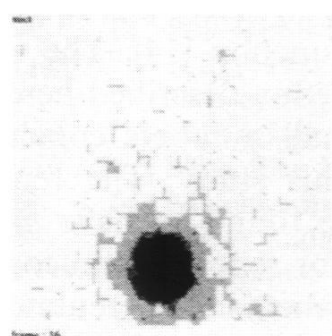
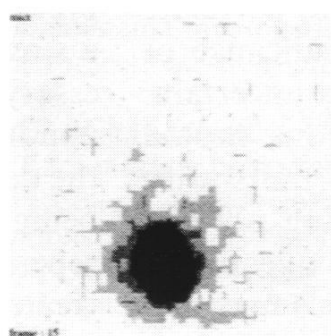
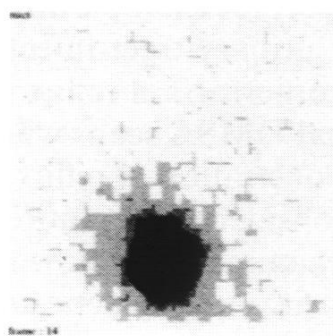
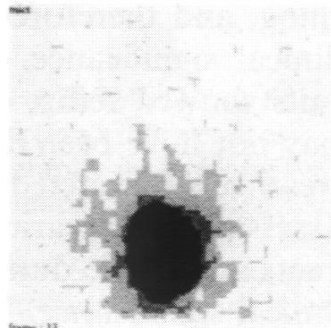
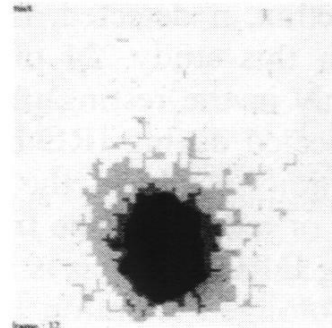
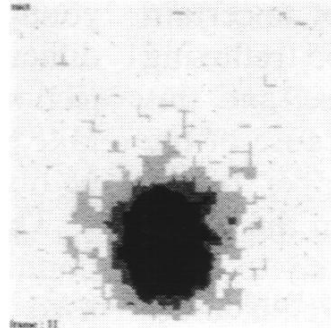
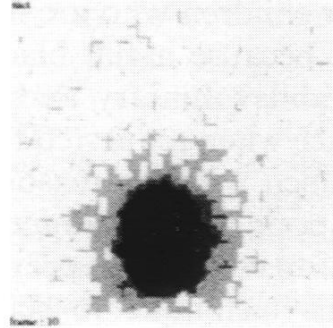




Indirect Radionuclide



e left
tion



2

3

4

5

6

L POST R

7'

8'

9'

10'

11'

12'

13'

14'

15'

16'

17'

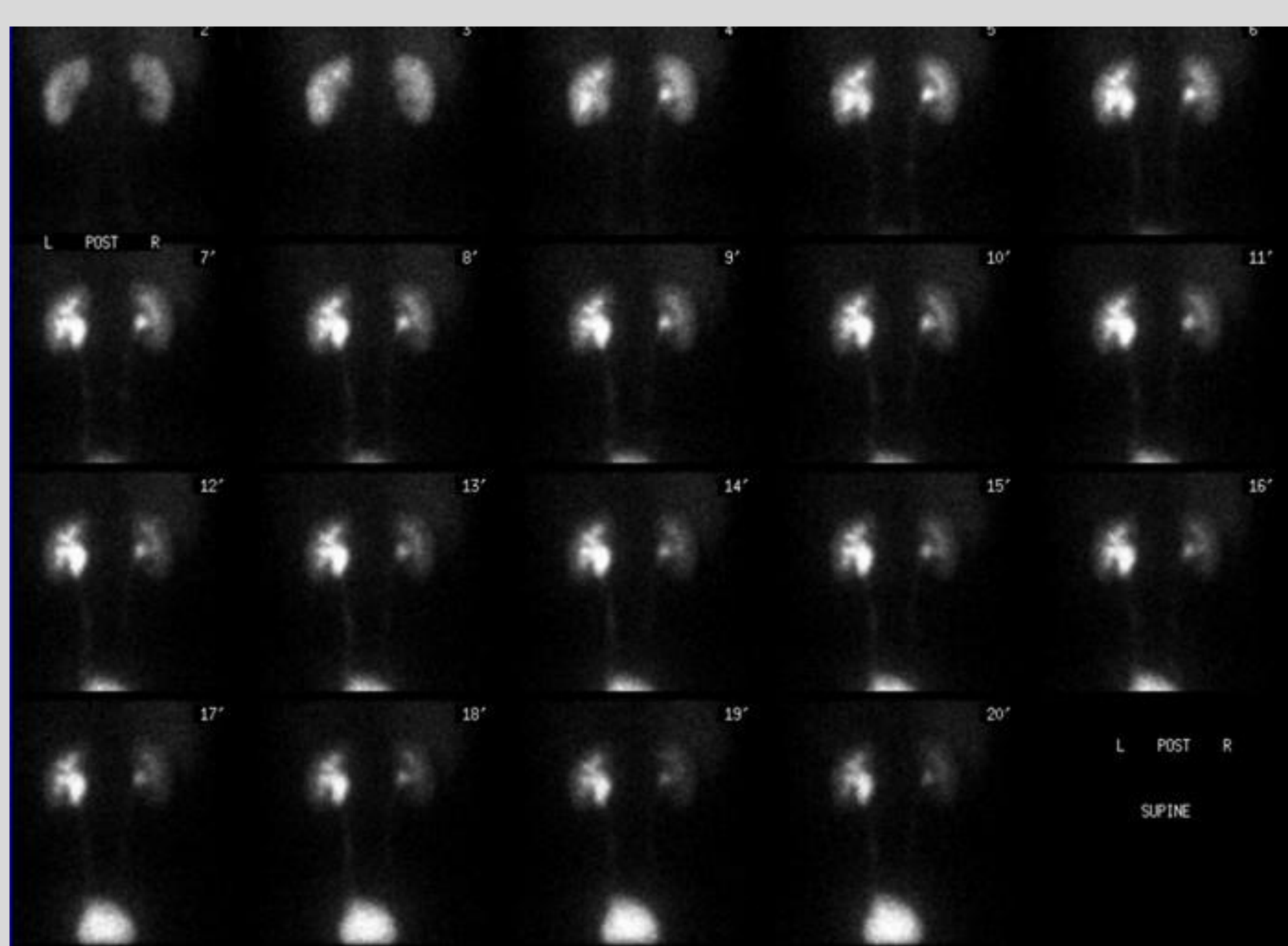
18'

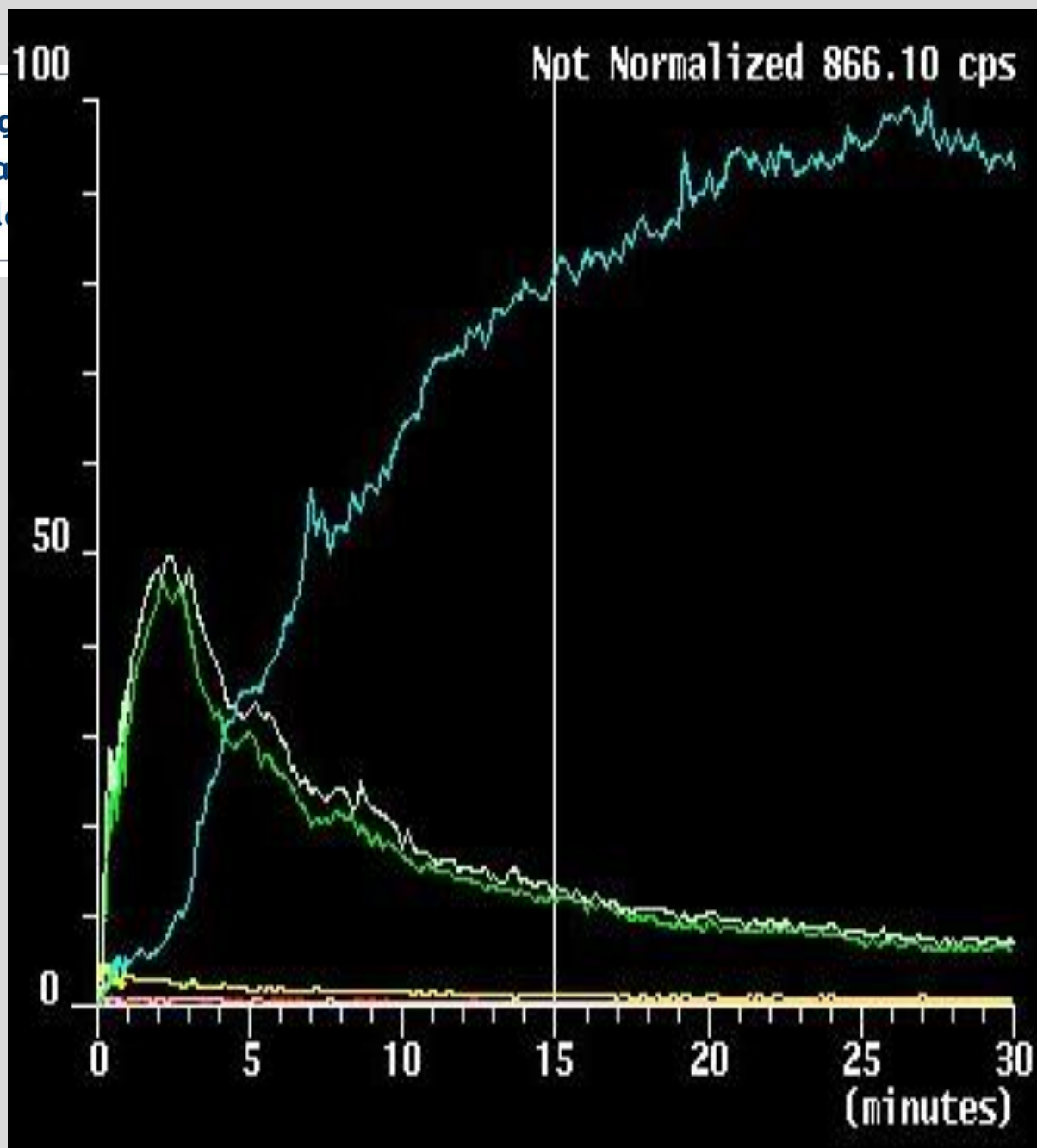
19'

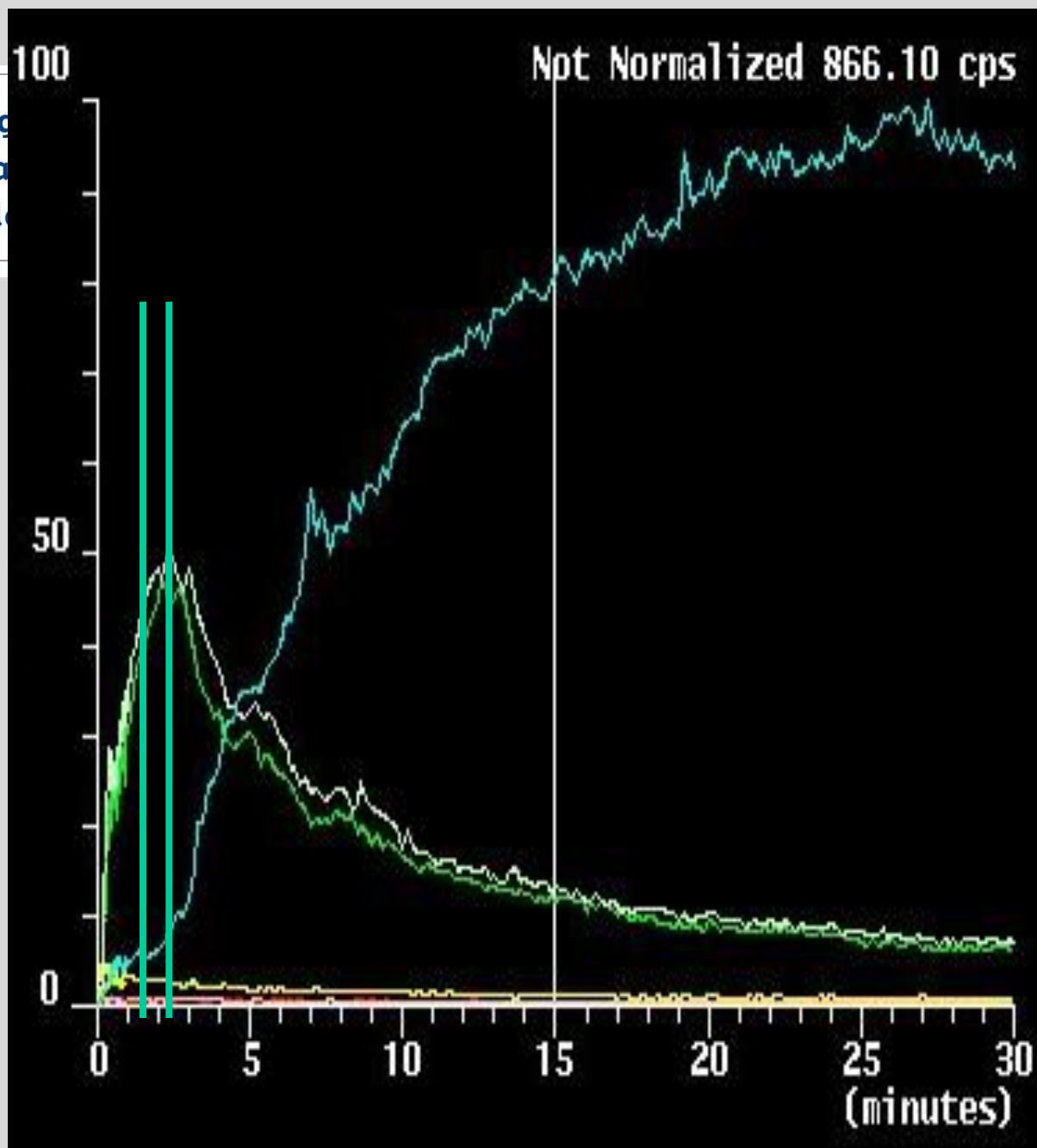
20'

L POST R

SUPINE









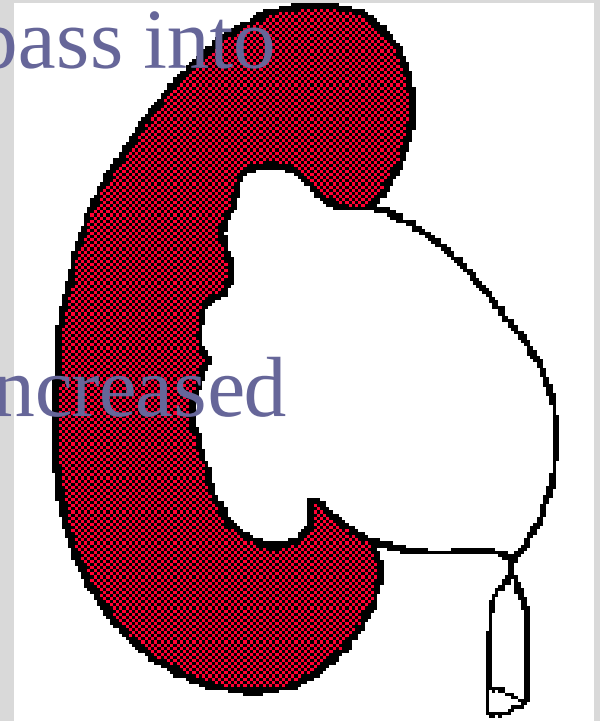
Function estimate

- Early part of the curve
- Before significant excretion
- Agrees with DMSA
- Can be affected by frusemide



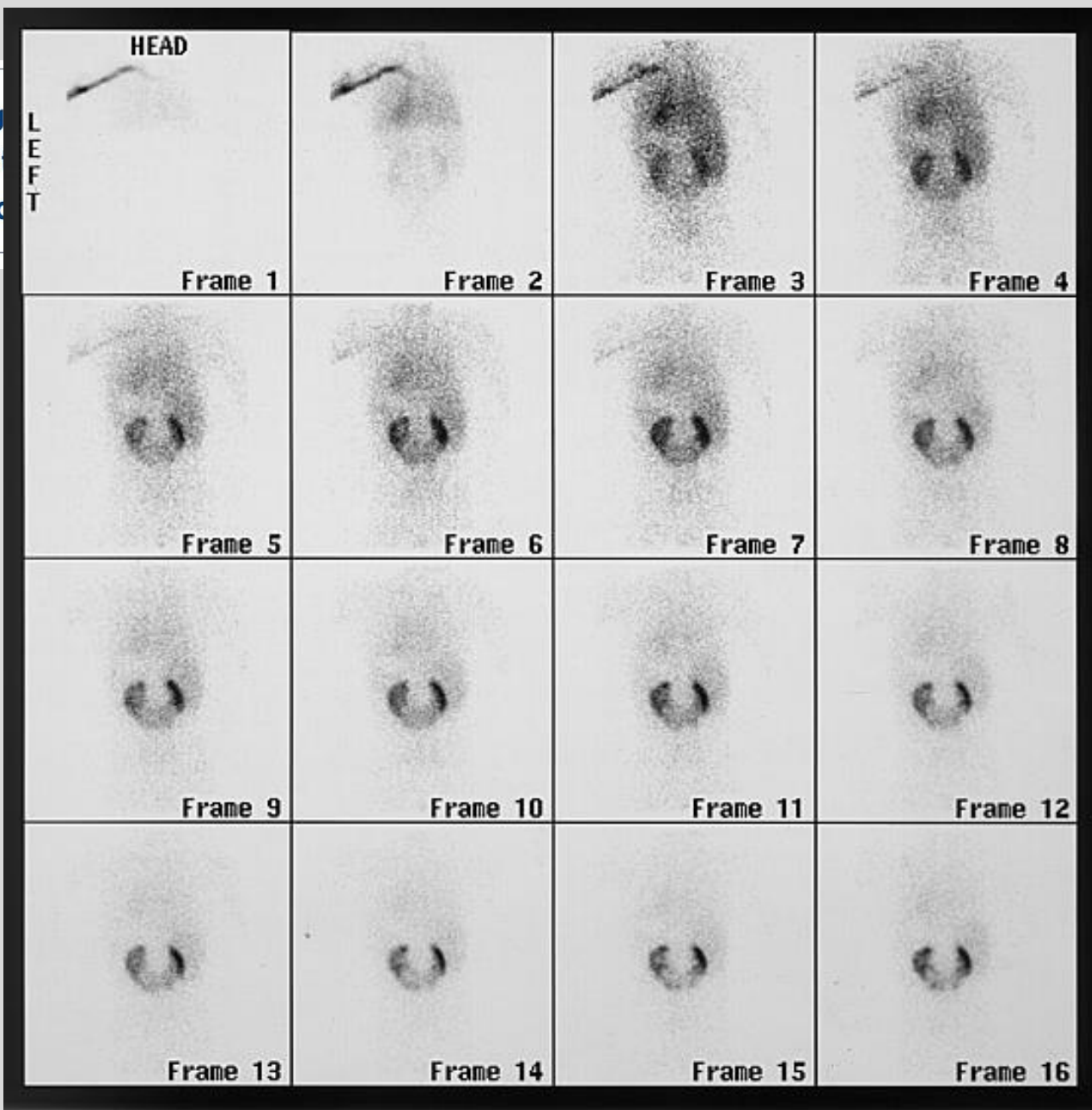
Pelvi-ureteric junction obstruction

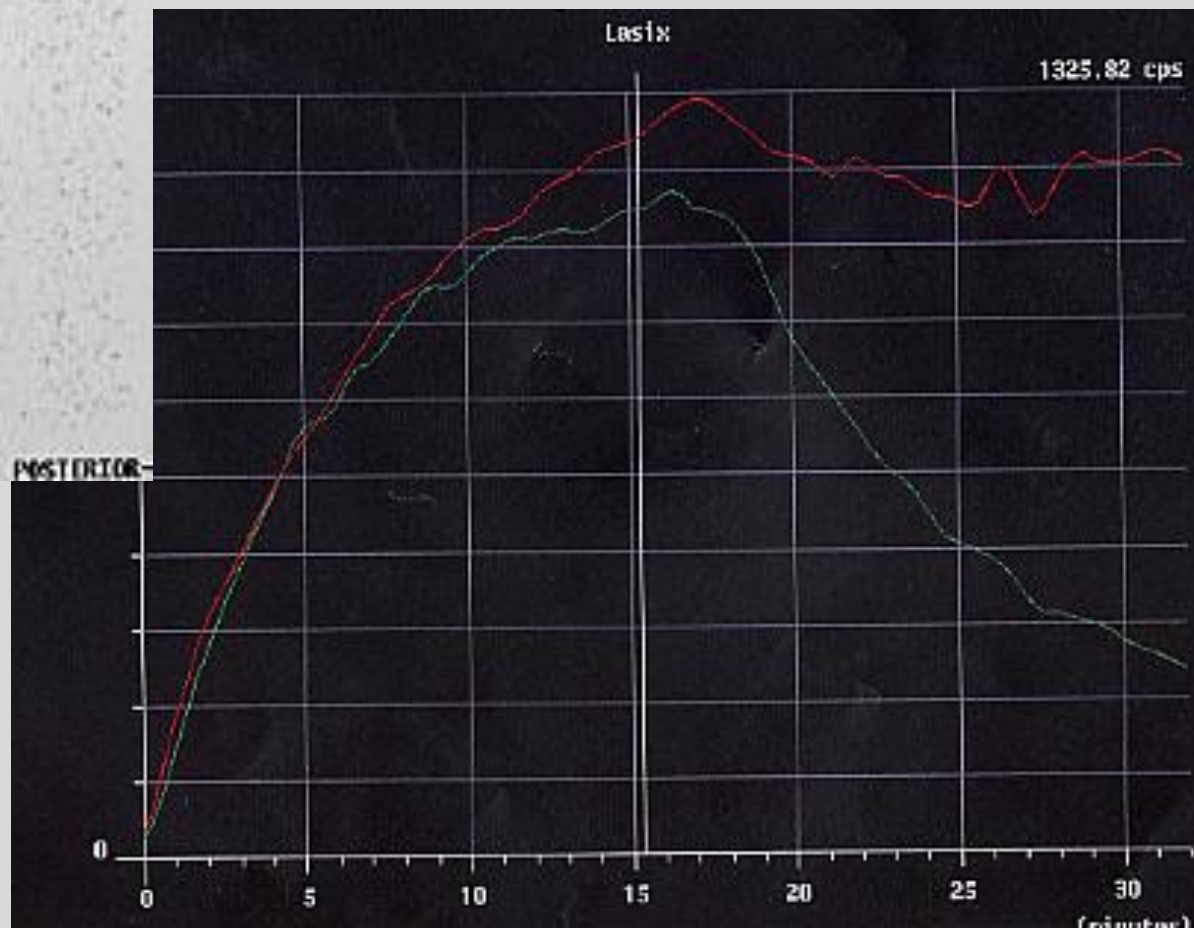
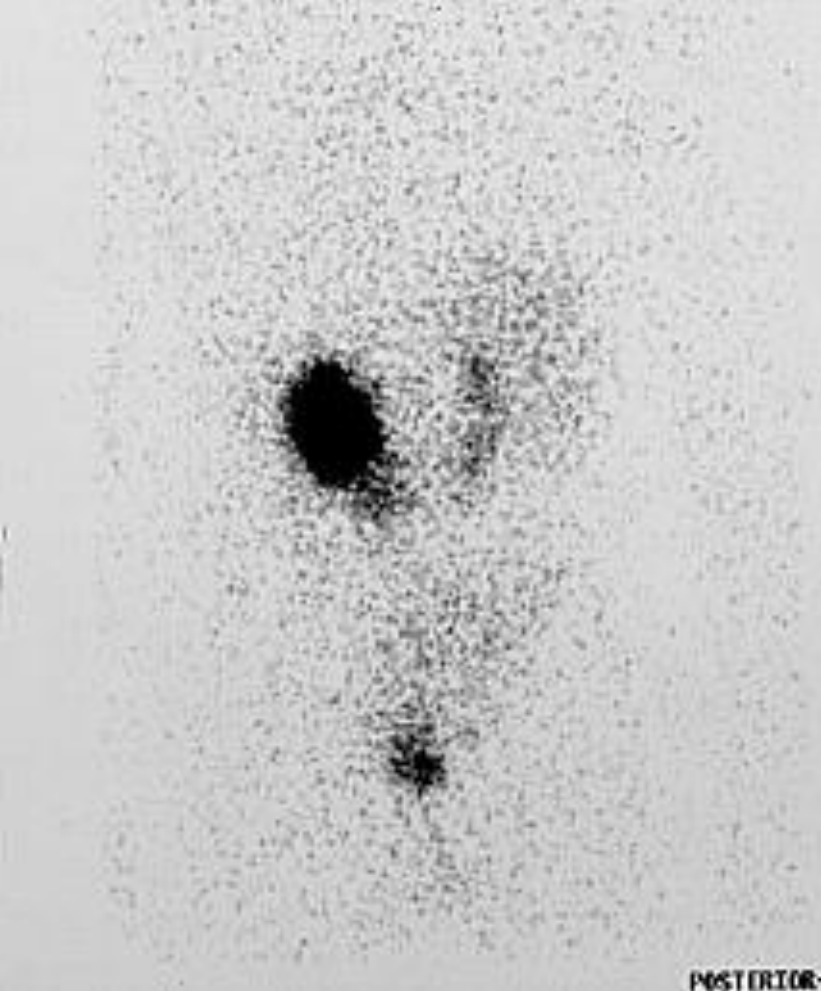
- Flank pain and hydronephrosis
- Failure of peristaltic wave to pass into proximal ureter
- 50% aberrant vessel
- Histology poor musculature, increased collagen



12 yo boy









Antenatal Dilatation

- 1-3% of all pregnancies
- Major workload and management issues

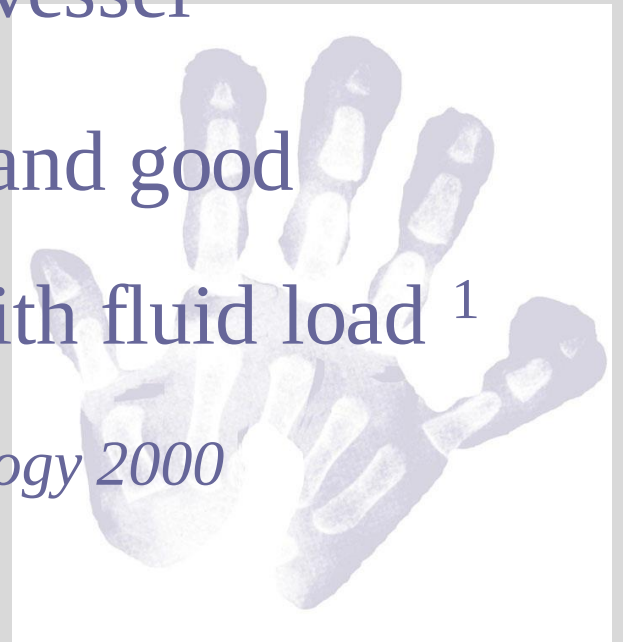




Pelvicalyceal dilatation- PUJ obstruction?

- Pathology similar at PUJ ²
- Only 11% (v 50%) crossing vessel
- 104 children with dilatation and good function 4 developed pain with fluid load ¹

¹Dhillon BJU 1998 ²Hanna Urology 2000





Is this the same condition?

- In some cases
- Natural history frequently benign
- Initial enthusiasm for surgery has waned





Postnatal US

- Relative dehydration after birth can lead to significant underestimation of hydronephrosis
- Some conditions need urgent treatment





May be due to reflux

- All dilatation may be secondary to reflux
- Cannot exclude reflux with US
- If intend to treat then need MCUG





How to identify those who will deteriorate

- No clear definition of obstruction
- Loss of function
- Recurrent UTI
- Loin pain





Who needs diuretic renography?

- Risks of pyeloplasty increase with increasing AP diameter
 - 15-20mm 7%
 - 30-40mm 61%
 - 50mm 100%

Dhillon 1998

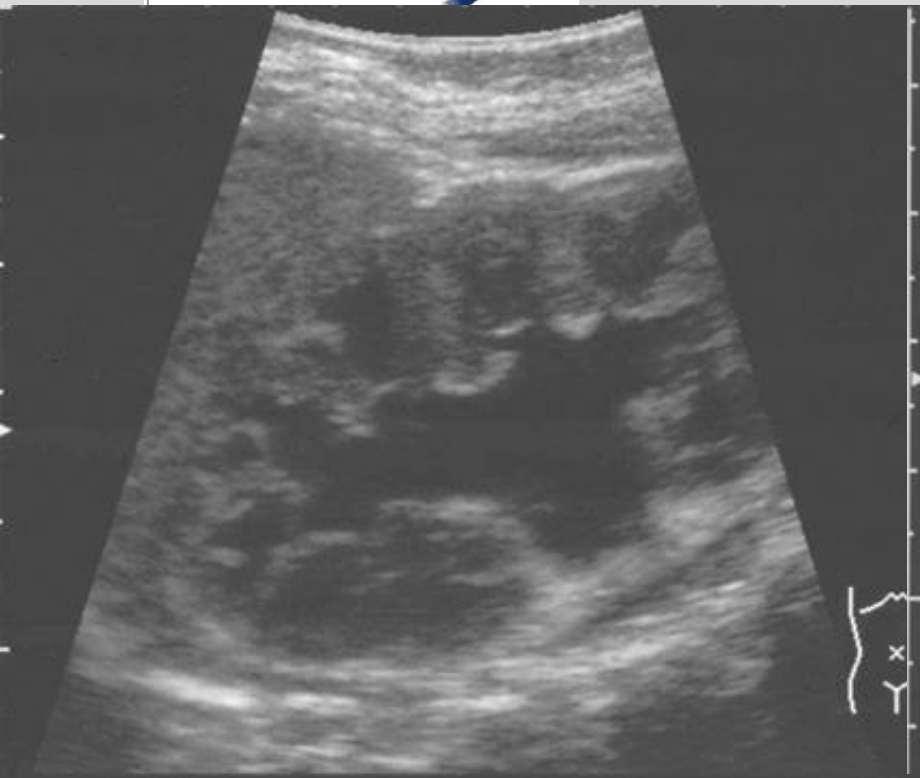




Calyceal dilatation

- Probably greater significance than pelvic diameter
- Extrarenal pelvis can be dilated with normal intrarenal pelvis
- Do not follow up unless present





Mild



Moderate

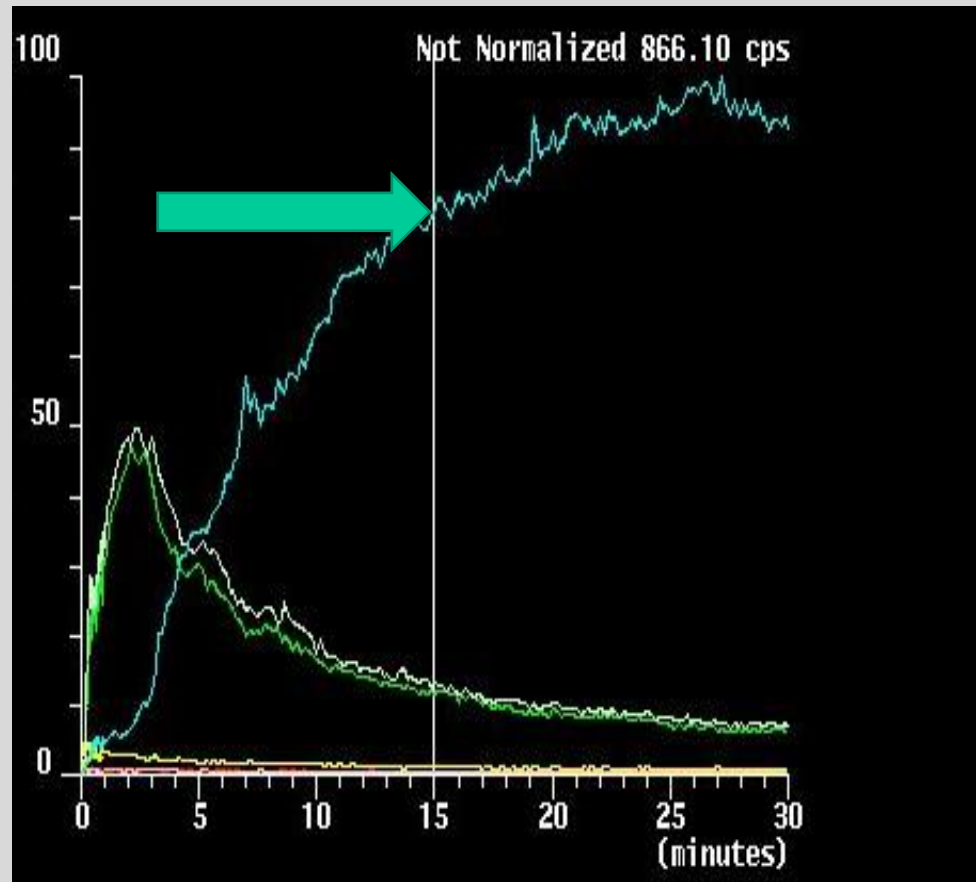
No
Pa
Ro





Diuretic renography

Renal pelvis > 1cm at hilum, prone image





Frusemide

- F-15 Radionuclide arrives in renal pelvis at time of maximum diuresis
- F0 similar results and easy in children
- Can interfere with function estimation
- F20
 - may not need to give diuretic
 - More equivocal results
 - May miss flow dependent obstruction

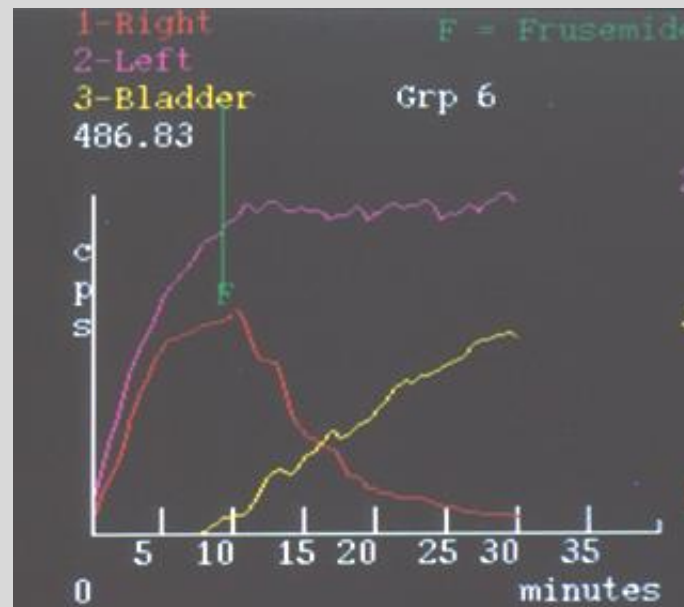
Turkolmez Clin Nuc Med 2004





Obstruction and renography

- T1/2
- Depends on renal blood flow and function, affected by state of hydration, size of renal pelvis

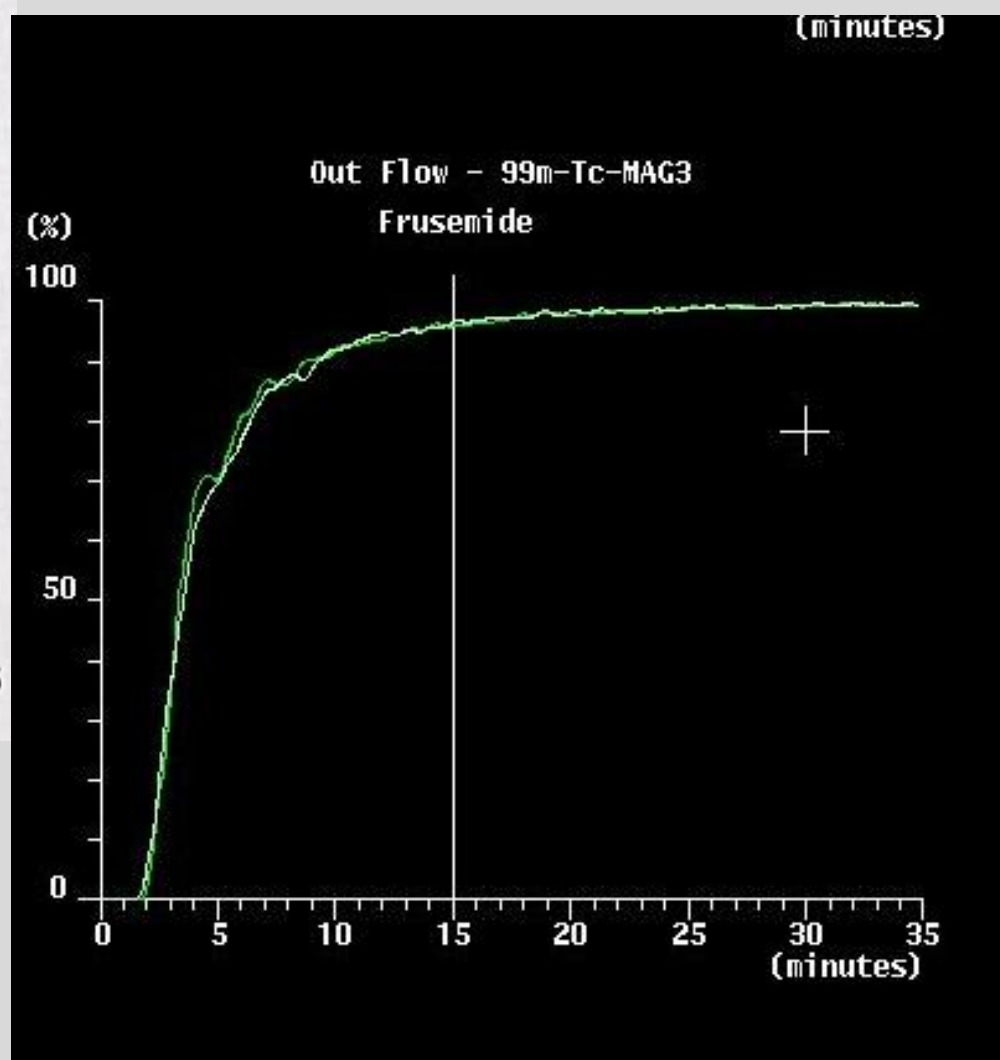
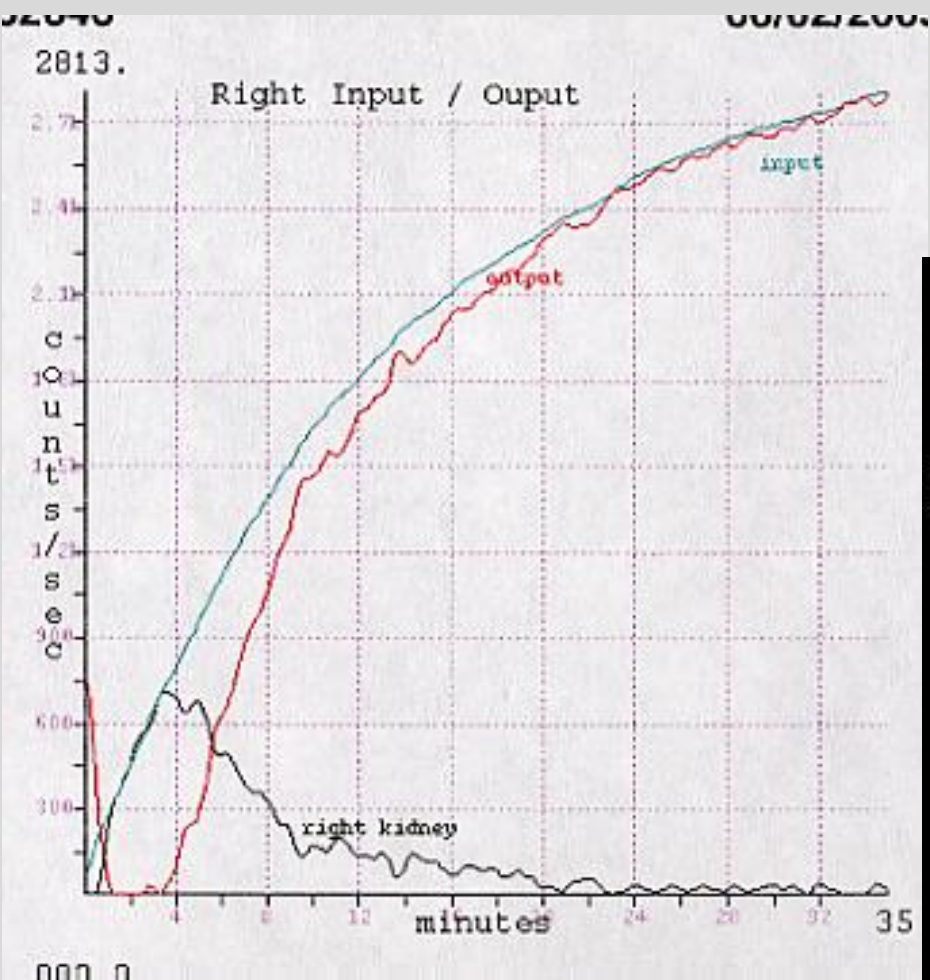




Obstruction and renography

- Output Efficiency
- Pelvic Extraction Efficiency
- Normalised Renal Activity
- All measure out as proportion of in, affected less by differences in function

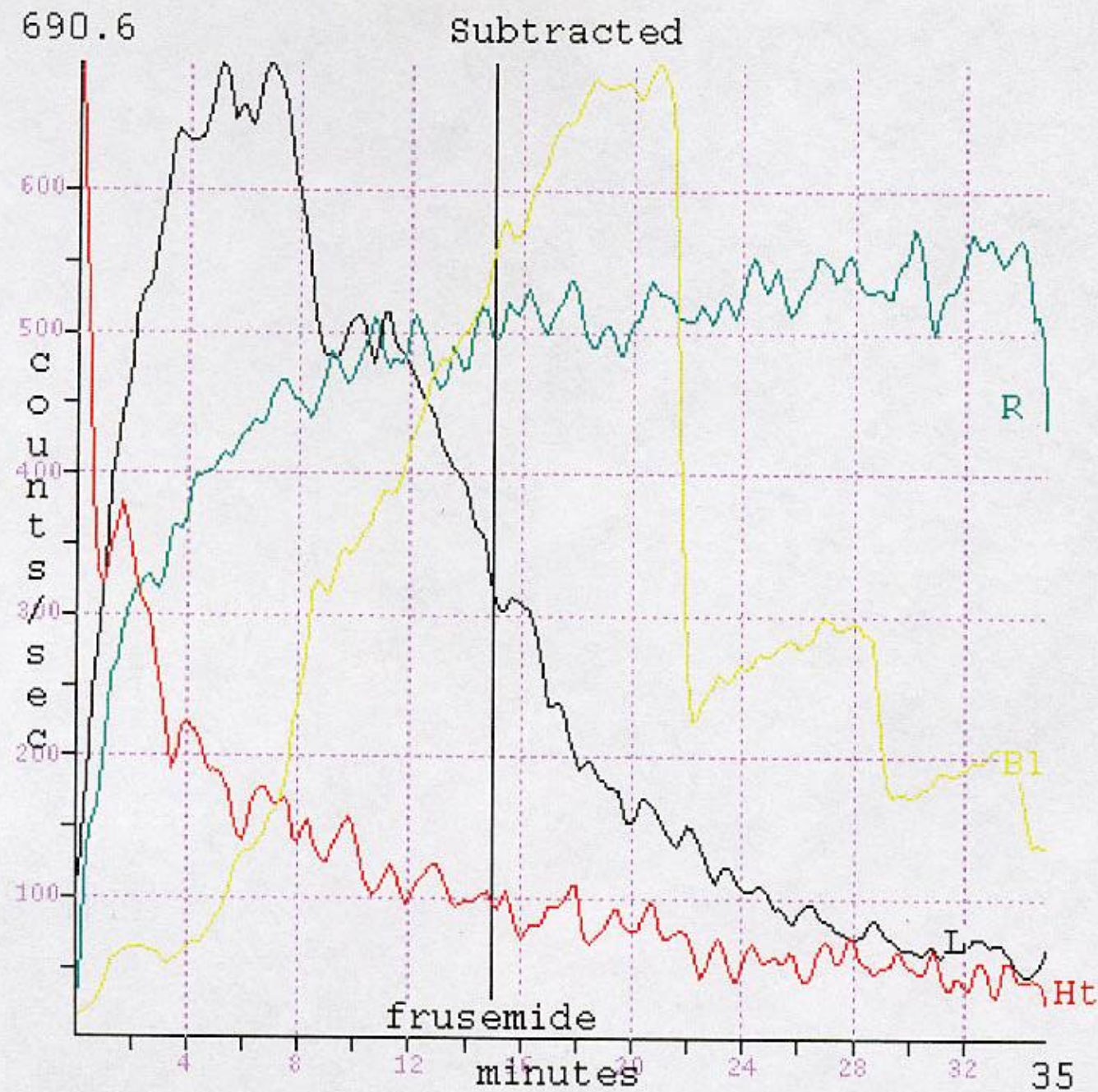




5/12 boy

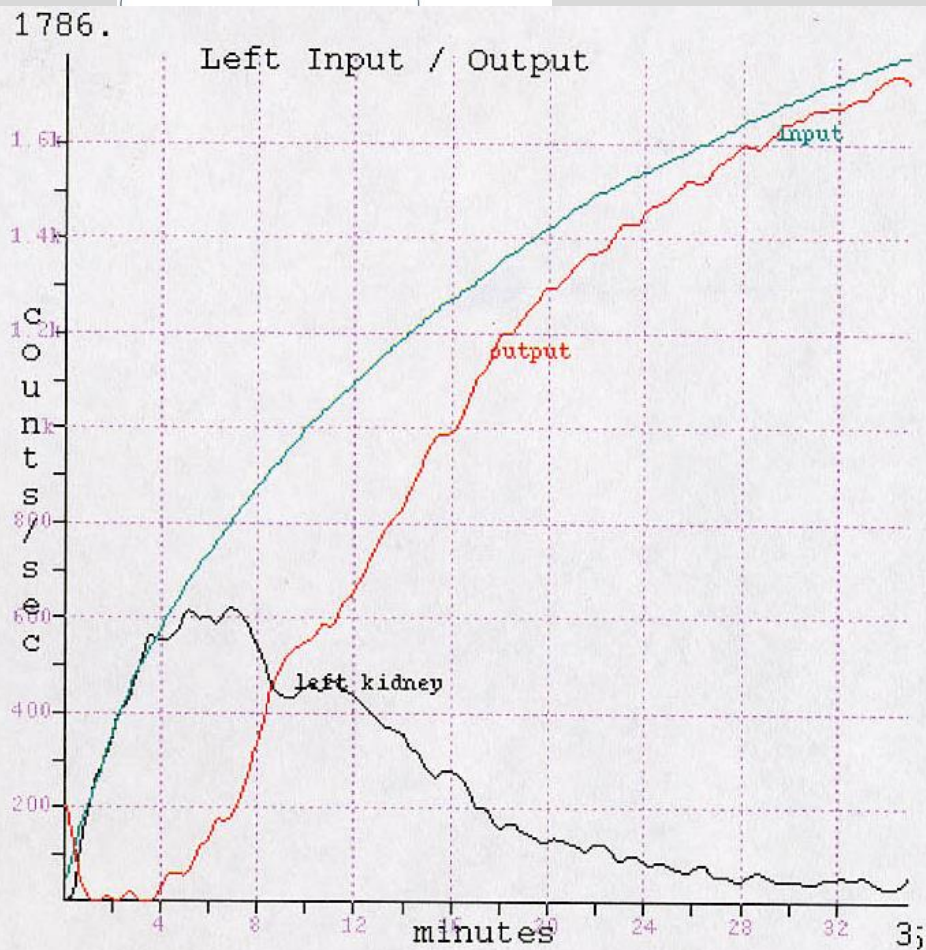
4cm

Subtracted

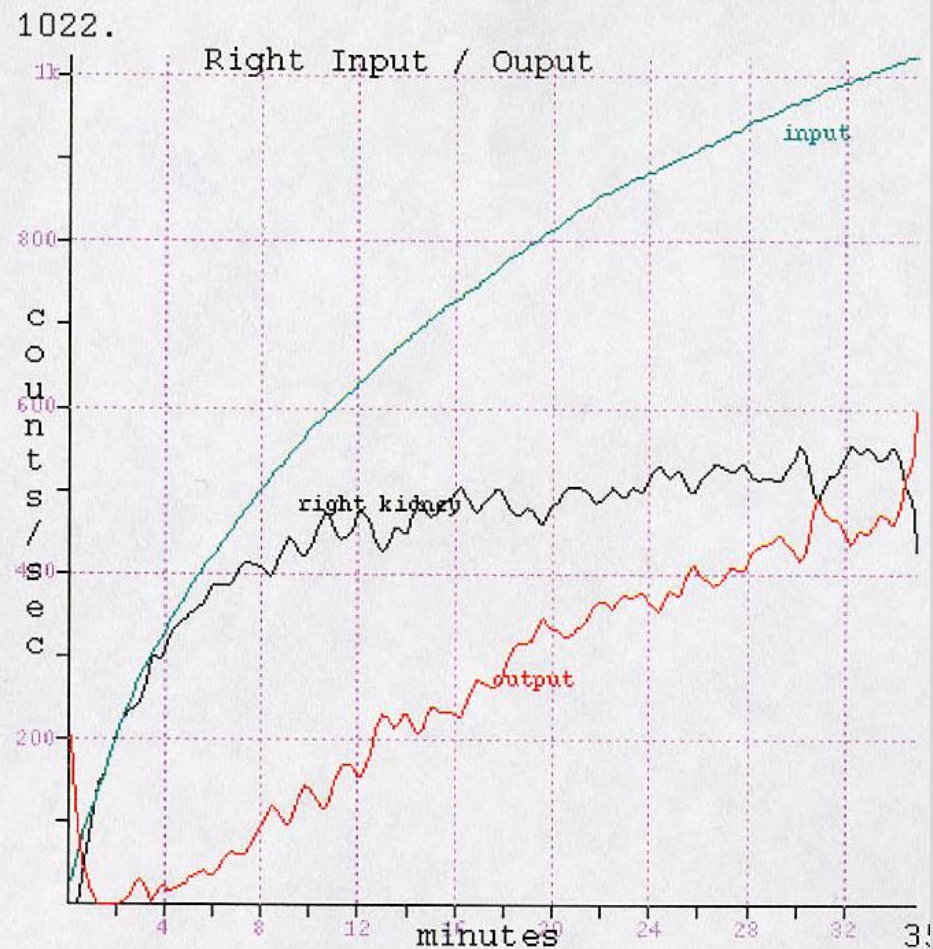


L=64%

R= 36%



L=98%



R=42%

OE



Other factors affecting drainage

- Size of collecting system
- Full bladder
- Gravity
- Post micturition view

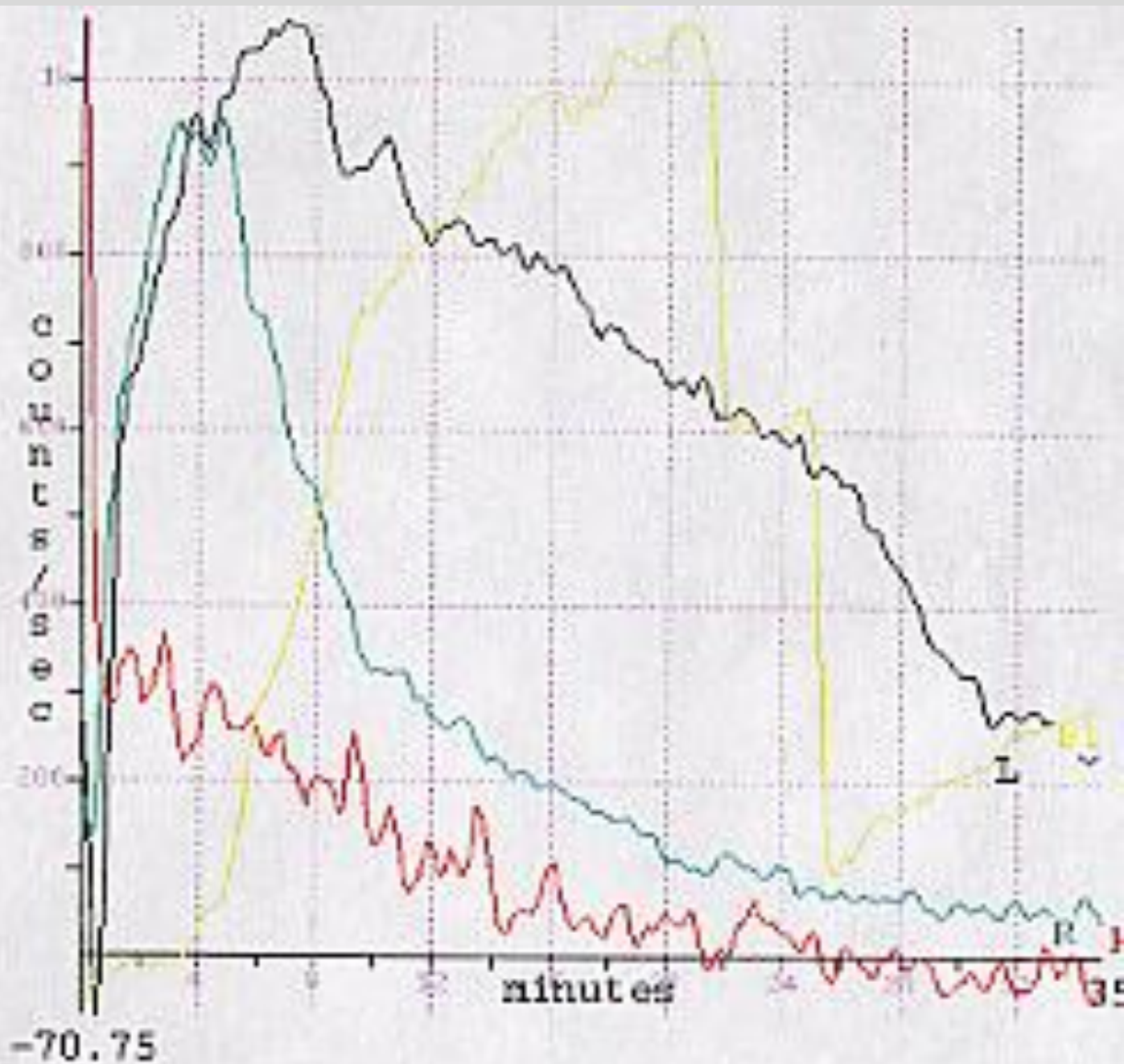


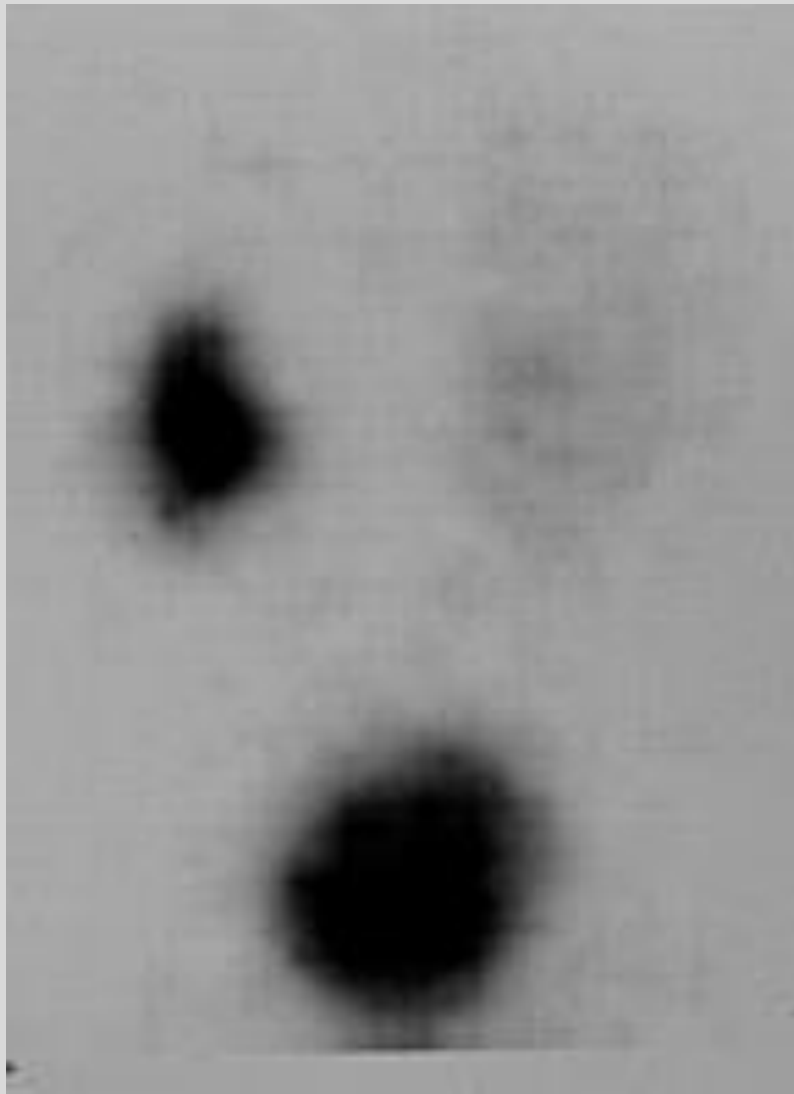


2/12 boy

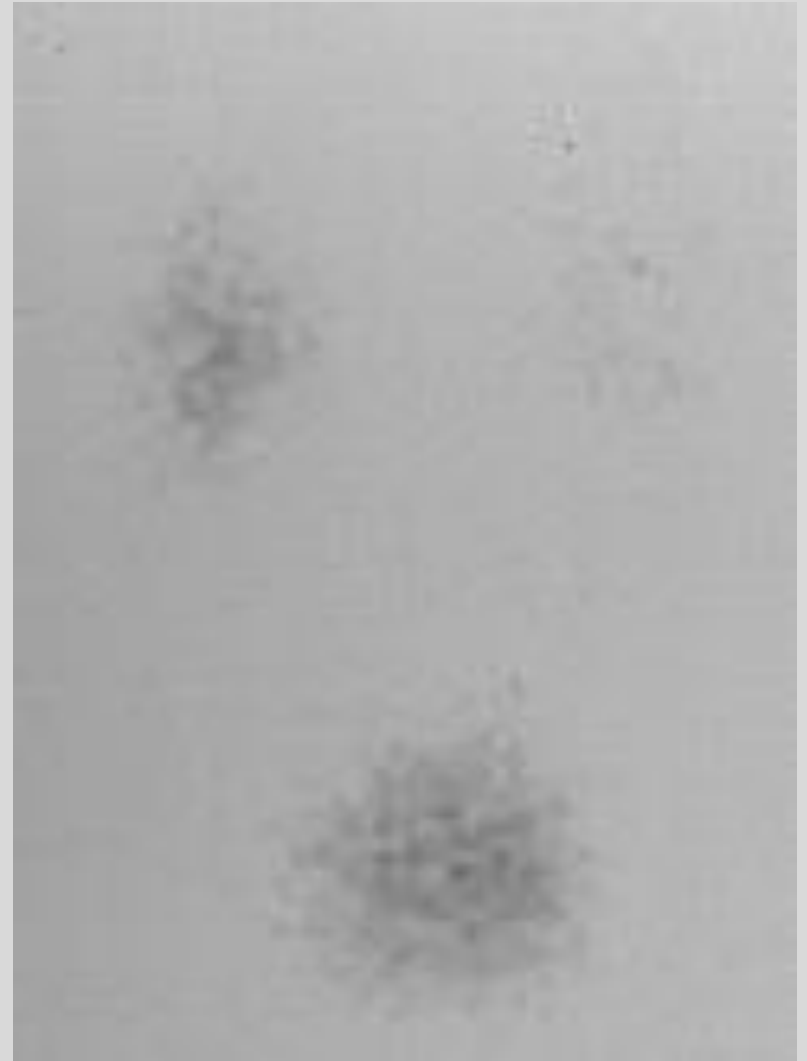
2.5cm







Pre mic

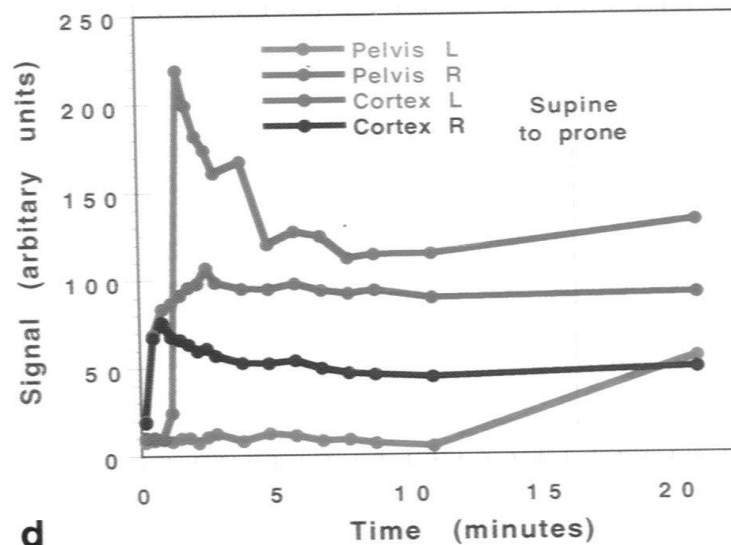


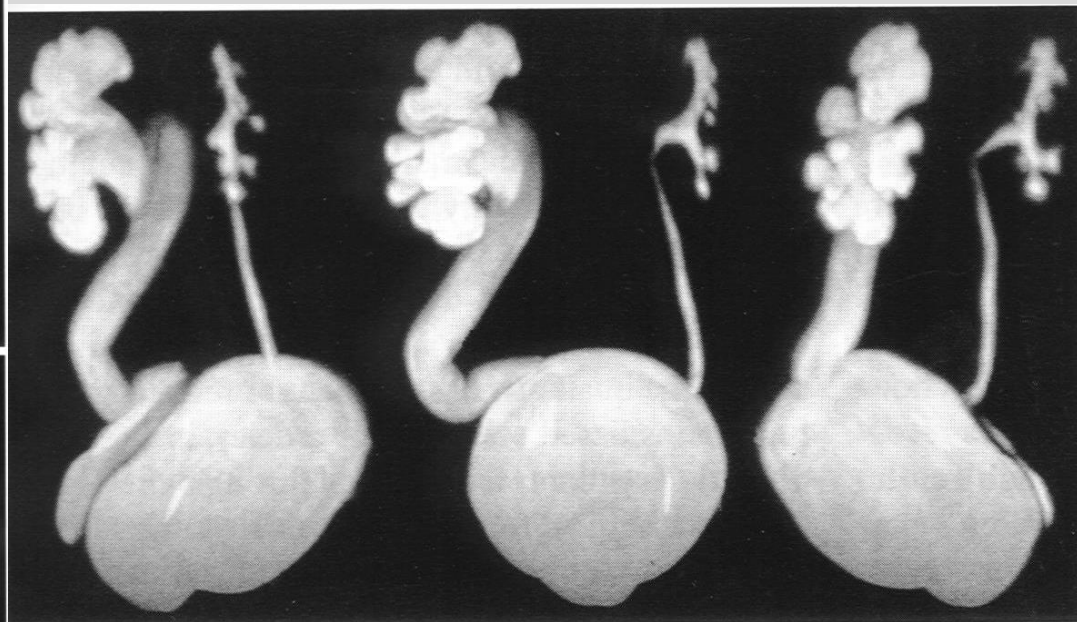
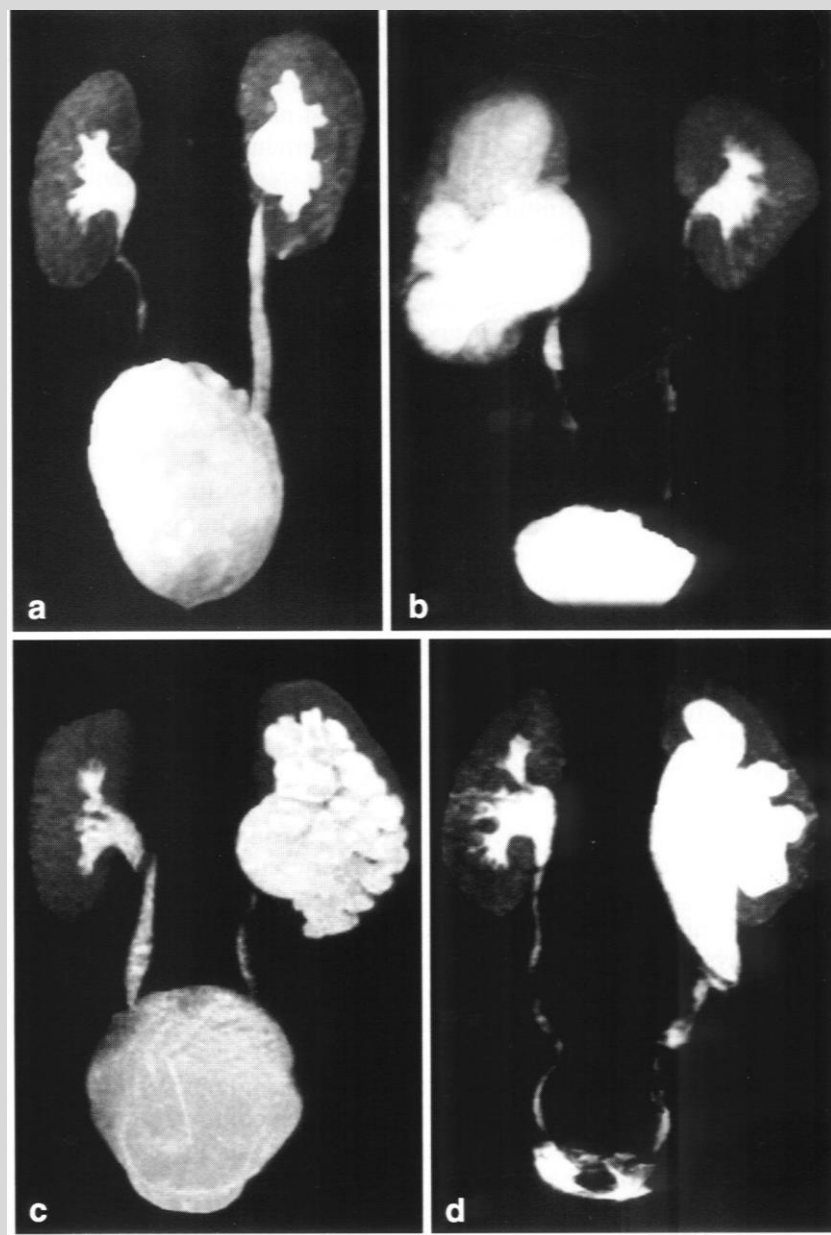
Post mic (60min)



Delayed image

- Can express residual function at 60 mins as a percentage of maximum
- Is this a better method to differentiate between sluggish and obstructed flow?
- Initial results pre and post pyeloplasty suggest this is a promising assessment





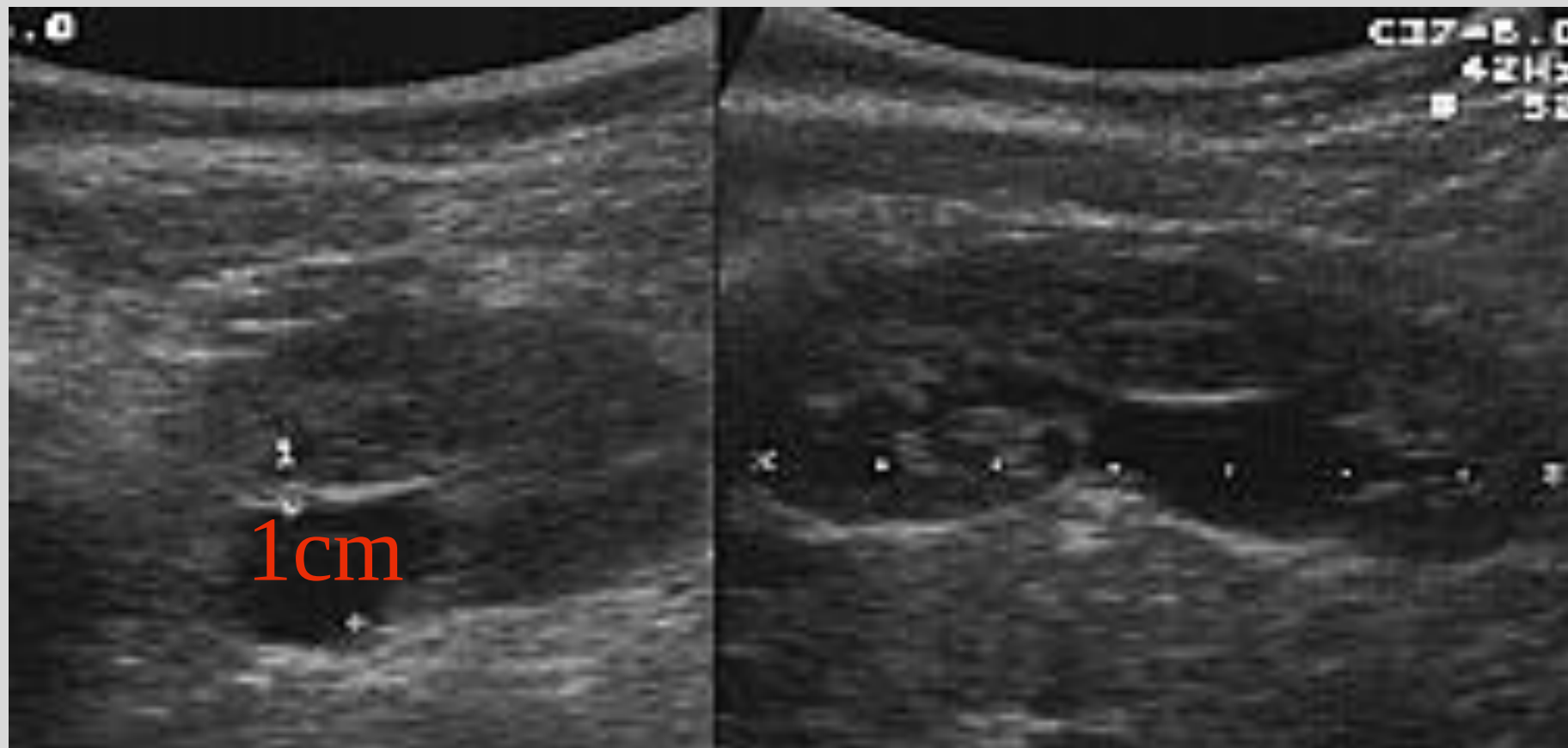


4/52 Left

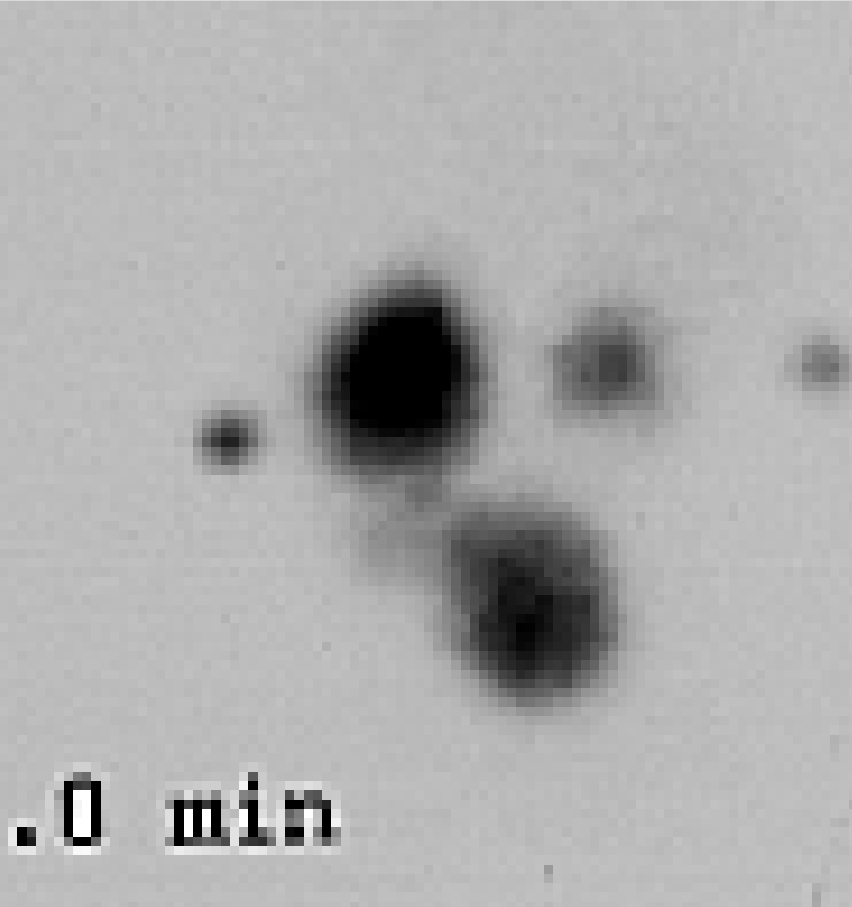




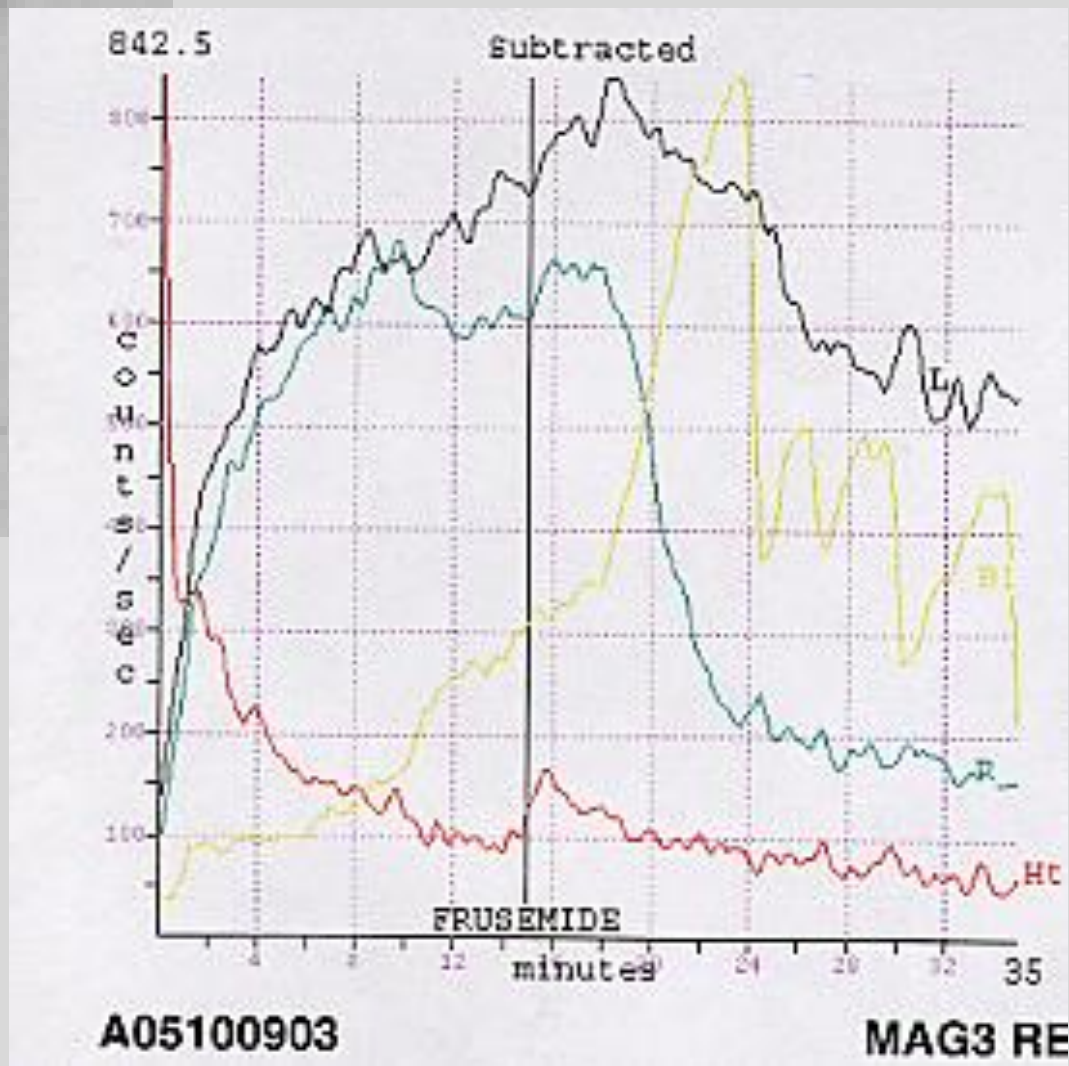
Right







3/12

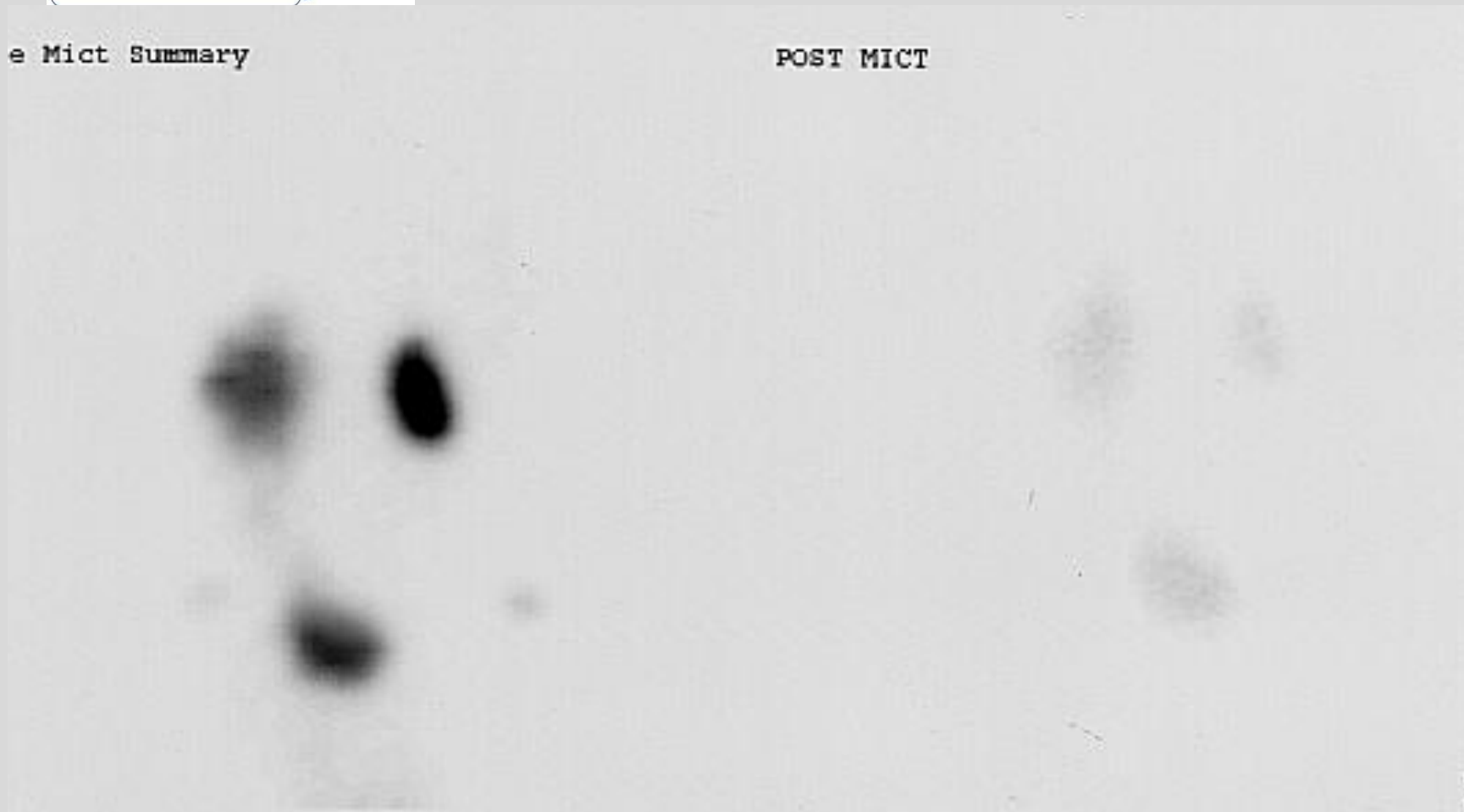


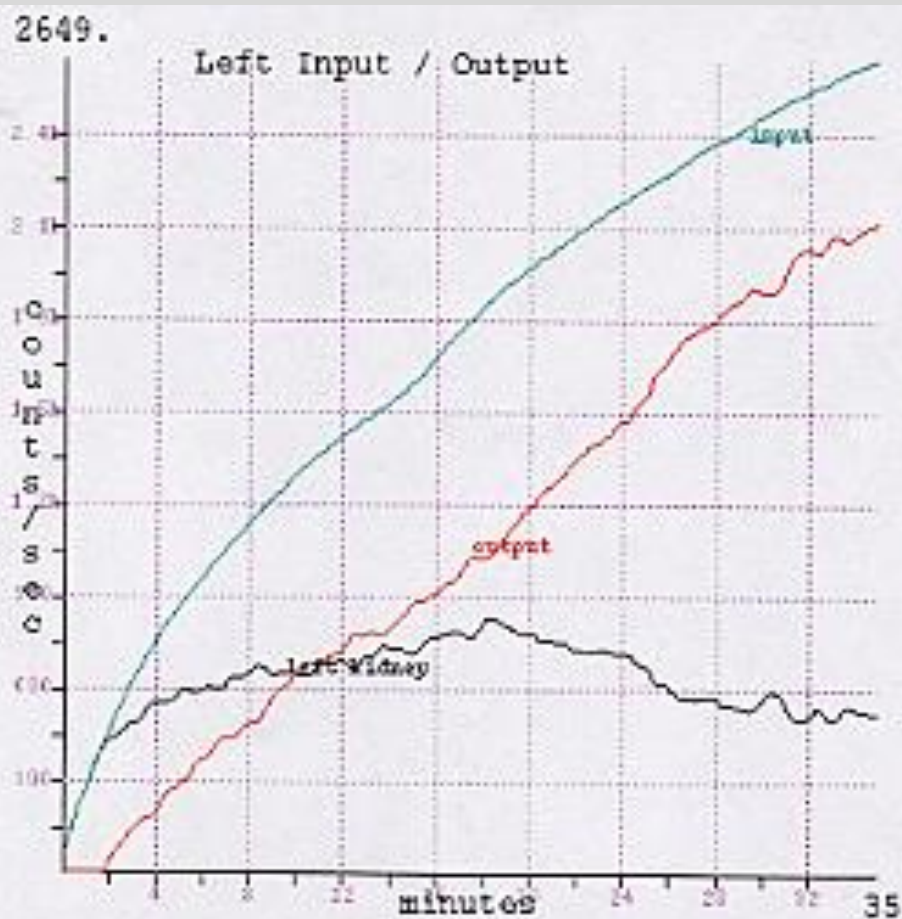


L=53% R=47%

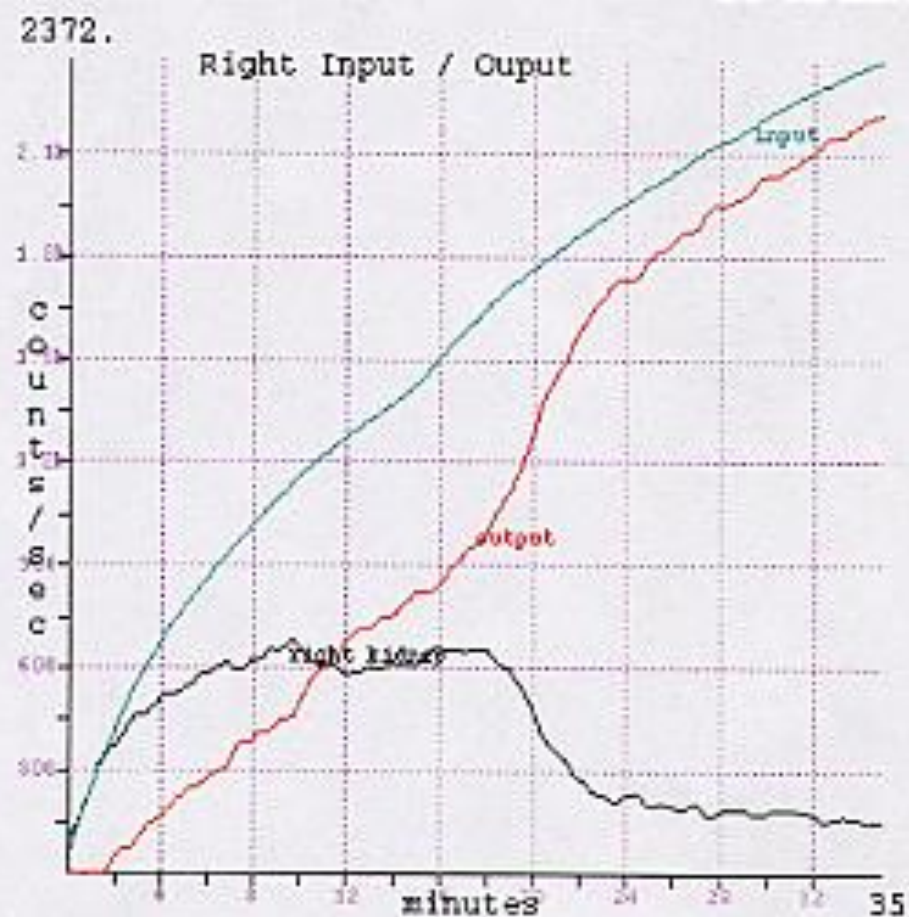
e Mict Summary

POST MICT





L=76%



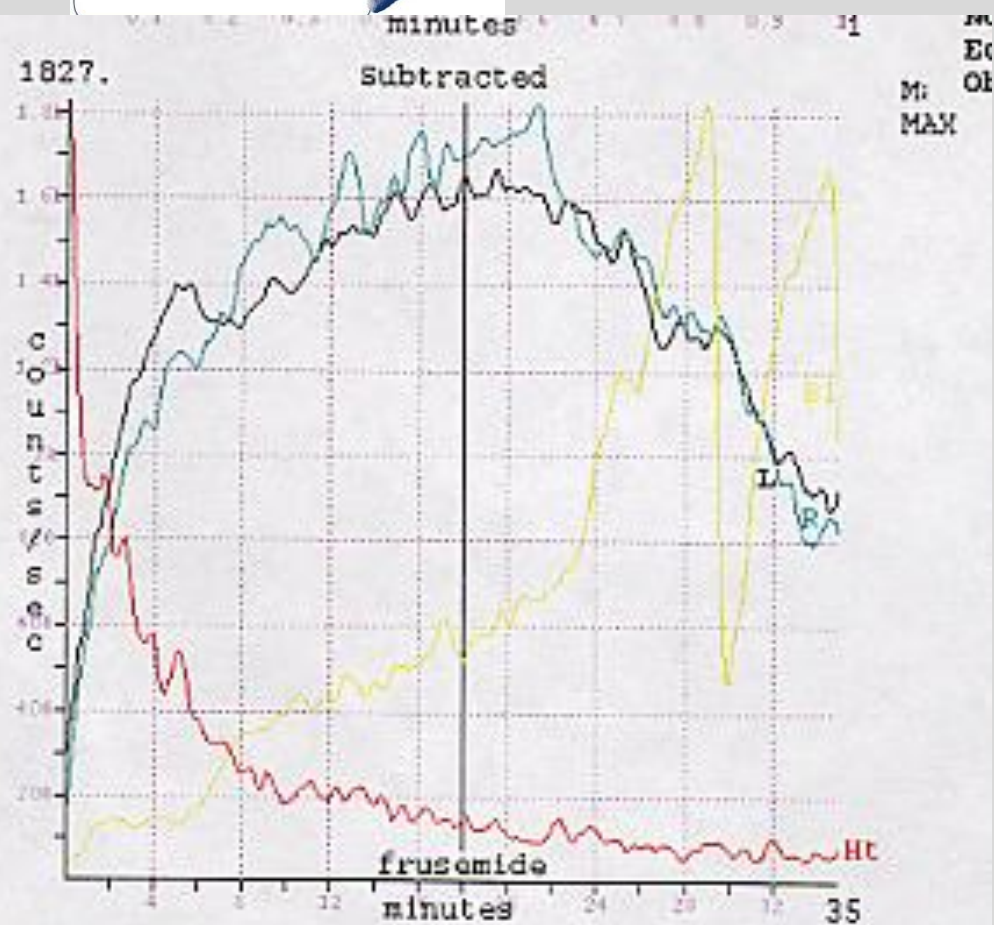
R=92%

7/12





13/12

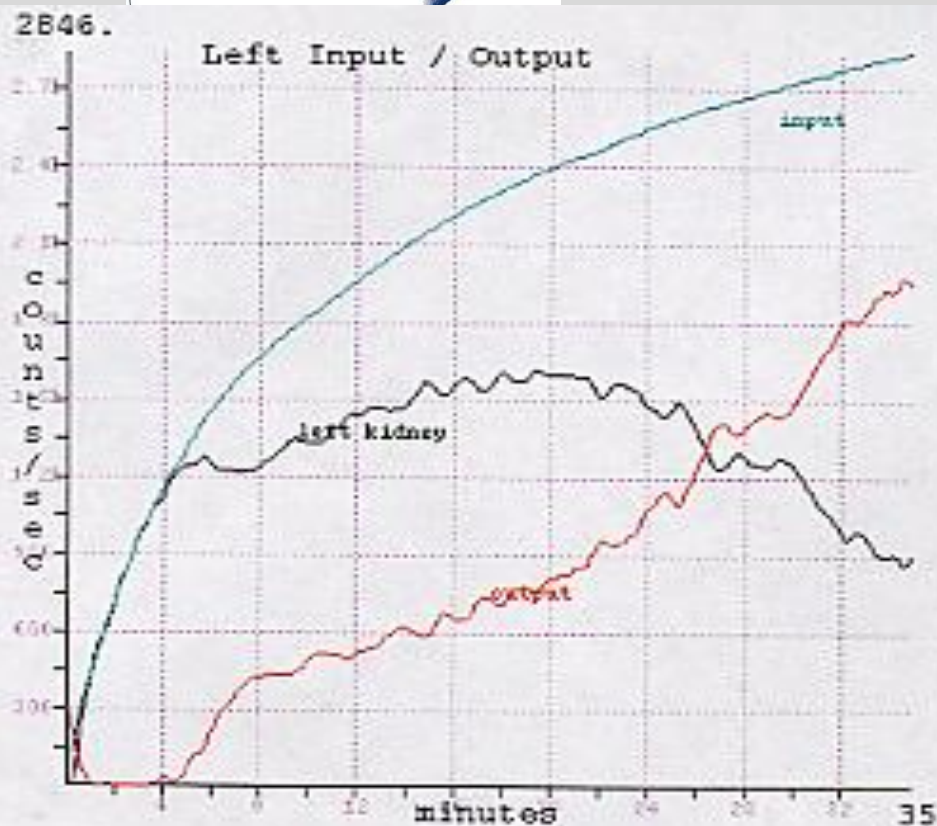


K1865378

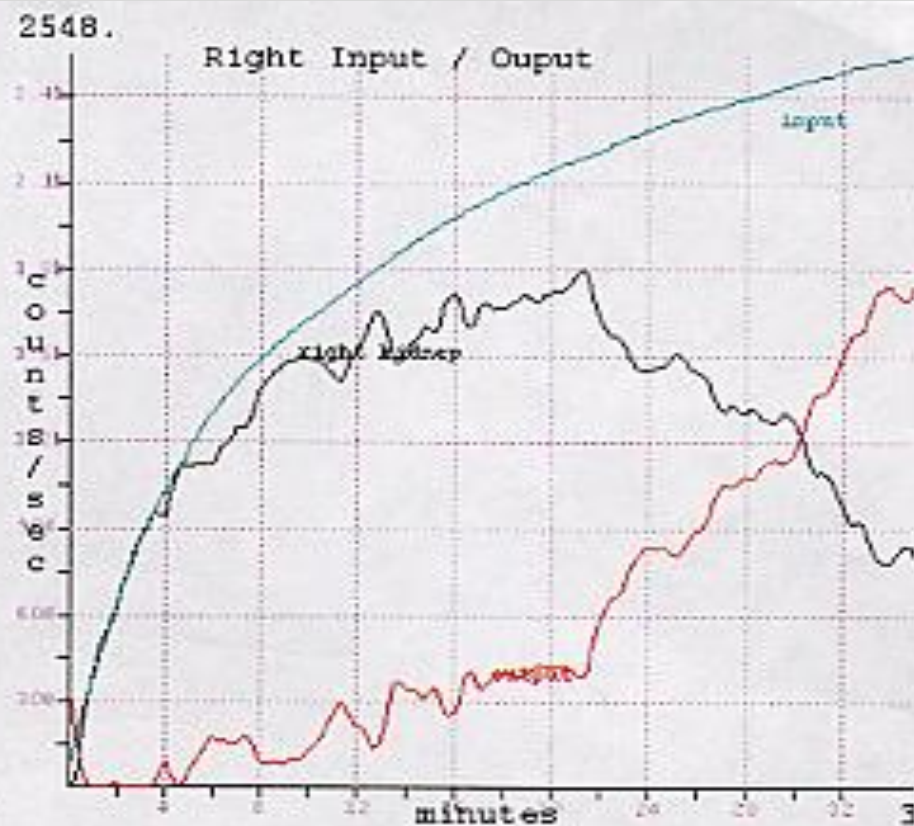
MAG3 RENOGI

L=53%

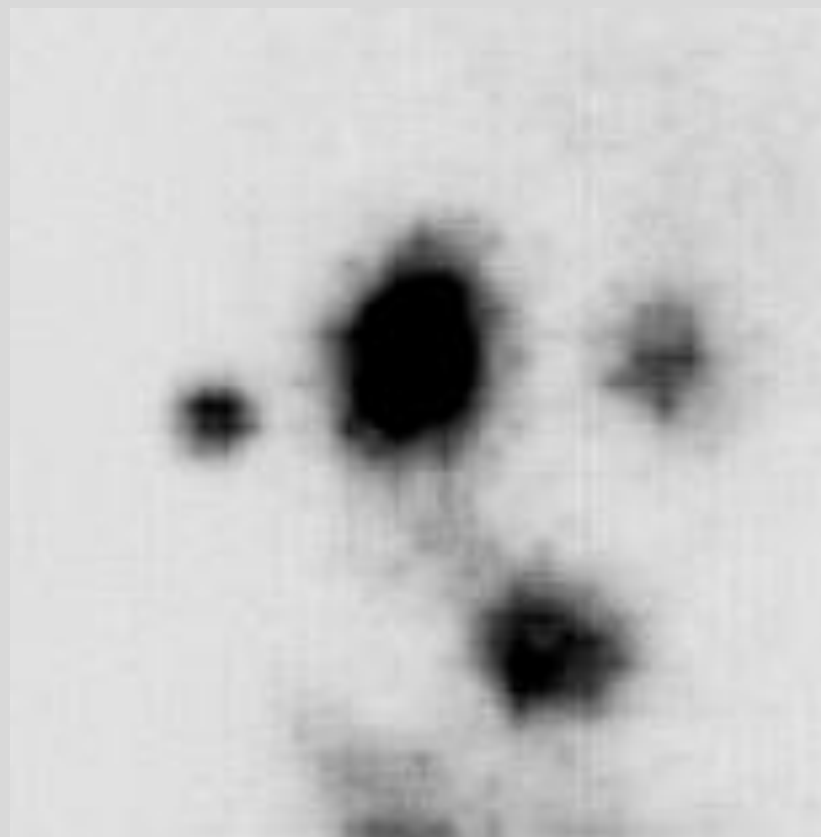
R=47%



L=54%



R=48%



Pre mic



City Hospital NHS Tr

1hr 40min

sp 6
mPp 33dB
ralet Low
Rate Med

T KIDNEY LB I

6.23cm

Post natal
scan 4/52

EY



UTI
19/12

