

To pee, or not to pee



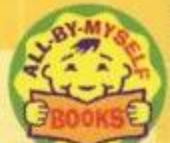
BELNUC Tech Day

19-11-2022

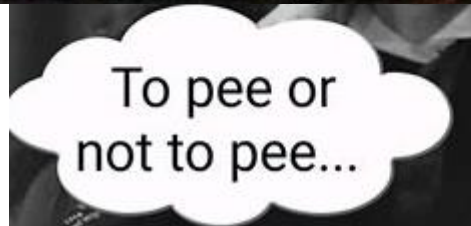
Dr. Eva Medaer

Dr. Raf Verscuren

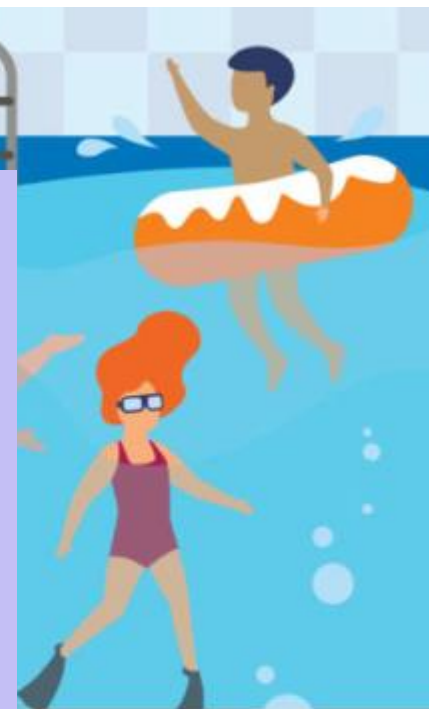
Includes Stickers and Tattoos!



Me waking up at 2am really needing to pee, but i want to stay in bed:



TO PEE, OR NOT TO PEE,
THAT IS NEVER THE
QUESTION.
PEE.



Question adults and children





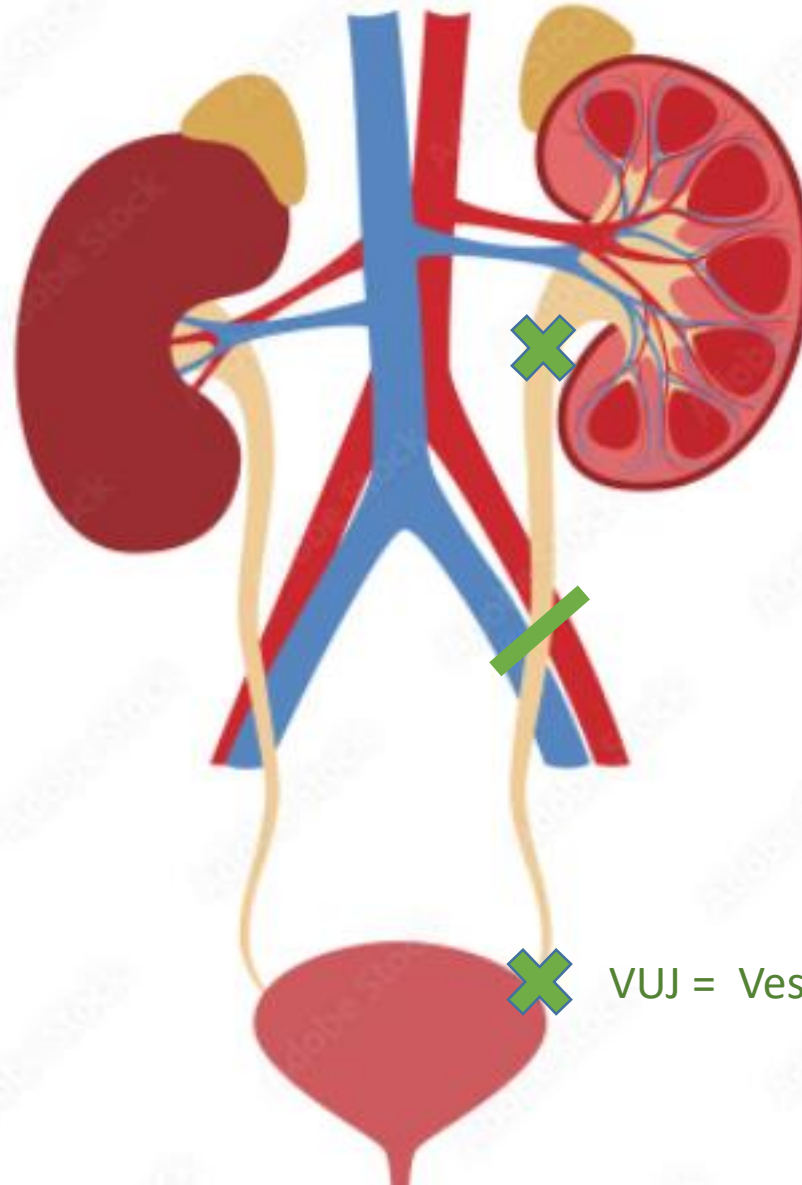
Pediatric Nephro-Urology: Overview and Updates in Diuretic Renal Scans and Renal Cortical Scintigraphy

Zvi Bar-Sever, MD,^{*} Amer Shammash, MD,[†] Farshid Gheisari, MD,[†] and Reza Vali, MD, MSc[†]

Nuclear medicine offers several diagnostic scans for the evaluation of congenital and acquired conditions of the kidneys and urinary track in children. Tc-99m-MAG 3 diuretic renal scans are most commonly used in the evaluation and follow up of urinary track dilations. They provide functional information on the differential renal function and on drainage quality which allows distinction between obstructed and non-obstructed kidneys and the need for surgical correction vs conservative management in kidneys with impaired drainage. Standardized imaging and processing protocols are essential for correct interpretation and for meaningful comparisons between follow up scans. Different approaches and conceptions led to some contradicting recommendations between SNMMI and EANM guidelines on diuretic renography in children which caused confusion and to the emergence of self-made institutional protocols. In Late 2018 the two societies published joint procedural guidelines on diuretic renography in infants and children which hopefully will end the confusion. Tc-99m DMSA scans provide important information about the function of the renal cortex allowing detection of acute pyelonephritis, renal scars dysplasia and ectopy as well as accurate determination of the differential renal function. They are commonly used in the evaluation of children with urinary tract infections and affect clinical management. A standardized imaging and processing protocol improves the diagnostic accuracy of these studies. SPECT or pinhole images should be a routine part of the imaging protocol. This is one of the recommendations in the new EANM and SNMMI procedural guidelines for renal cortical scintigraphy in children available online on the SNMMI website and is under publication. This article provides an overview on the clinical role of diuretic renography and cortical scintigraphy in children and describes the imaging protocols focusing on the new recommendations in the procedural guidelines.

Semin Nucl Med 52:419-431 © 2021 Elsevier Inc. All rights reserved.

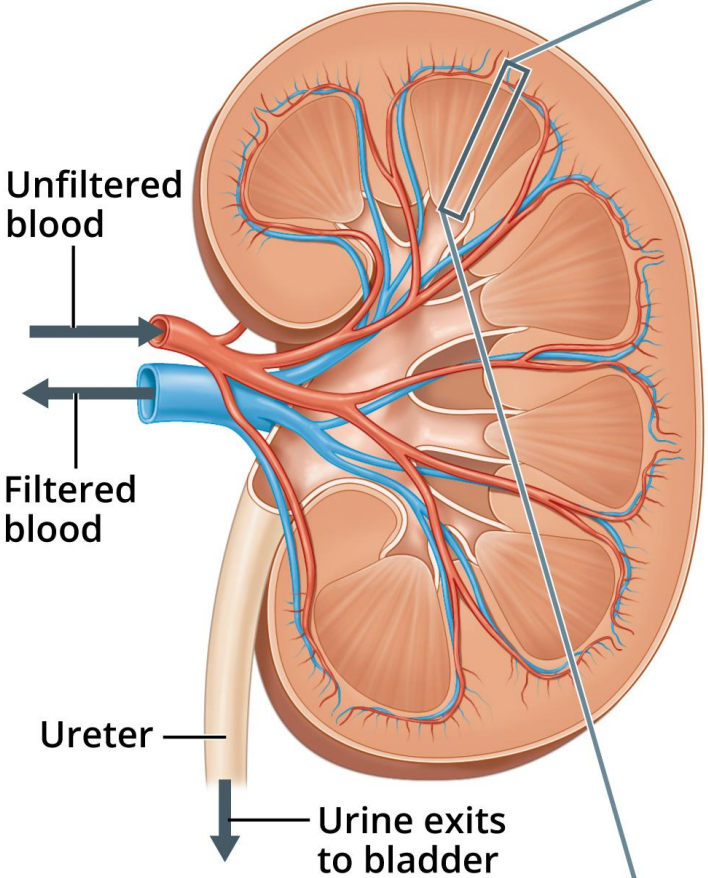
Anatomy of the urinary system



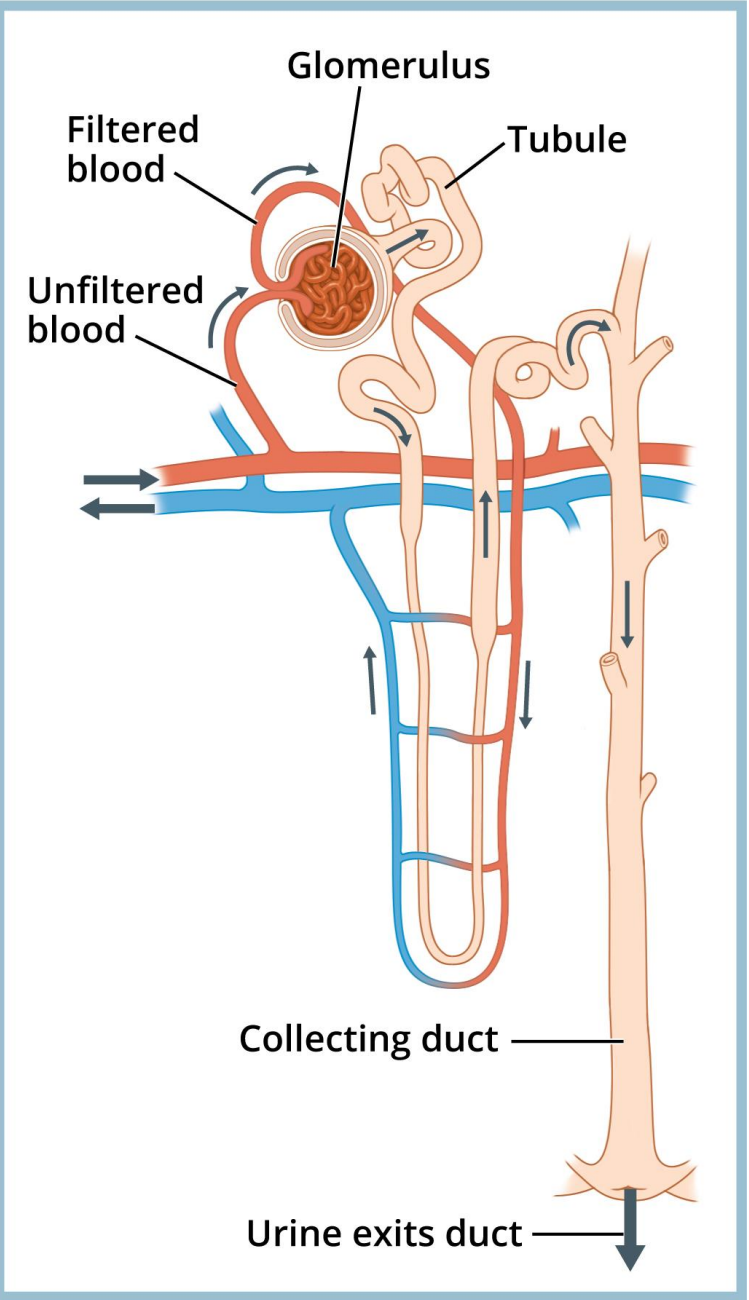
PUJ = Pyelo-Ureterale Junctie

VUJ = Vesico-Ureterale Junctie

Kidney

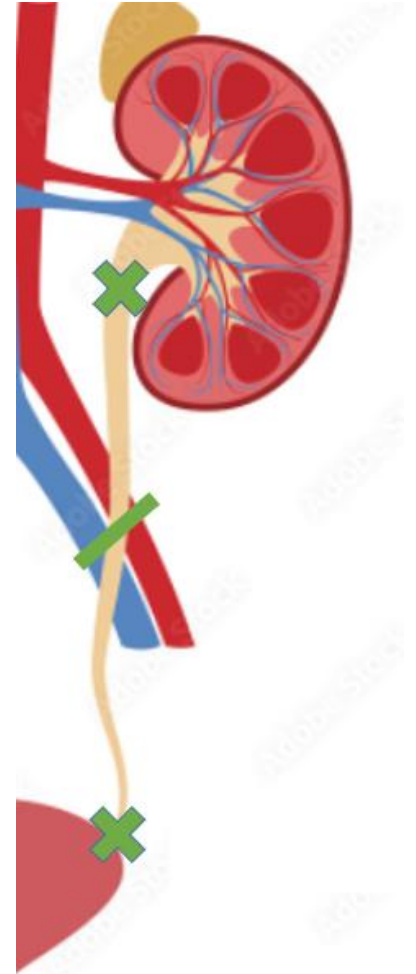


Nephron



Dynamisch renogram

MAG-3, EC, (DTPA)



Indicatie

- Urinaire afloop van de nieren naar de blaas evalueren
- Aanleiding vaak een (al dan niet toevallige) vondst van uitgezet pyelon

Bijkomende info:

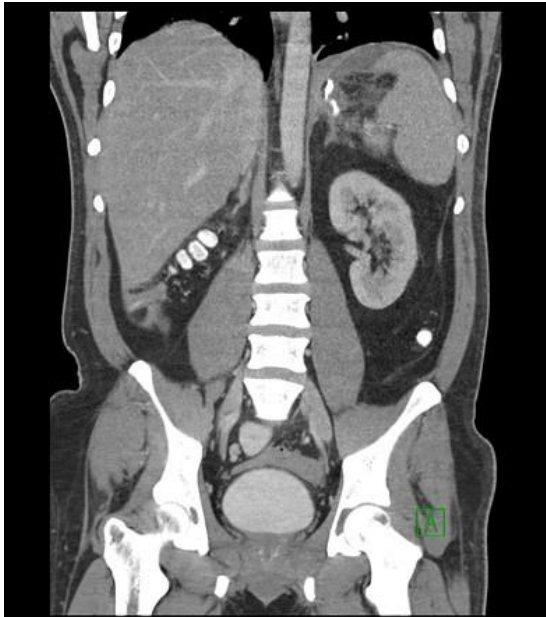
- Grootte en ligging van de nieren
- Relatieve functie van beide nieren, indruk van de globale nierfunctie
- Doorbloedingsproblemen: functionele nierarteriestenose
- Functiestoornissen van een transplantaat

MAG-3, EC

- (wordt tubulair gesecreteerd)
- Een normaal renogram bestaat uit 3 delen:
 - ✓ perfusiefase
 - ✓ parenchymfase
 - ✓ excretiefase

Nazicht dossier - vroegere beeldvorming

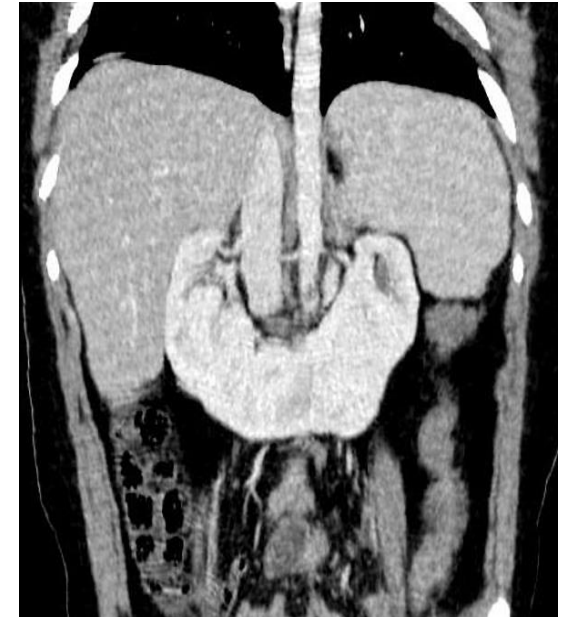
Unieke nier



Ectopische ligging



Hoefijzernier

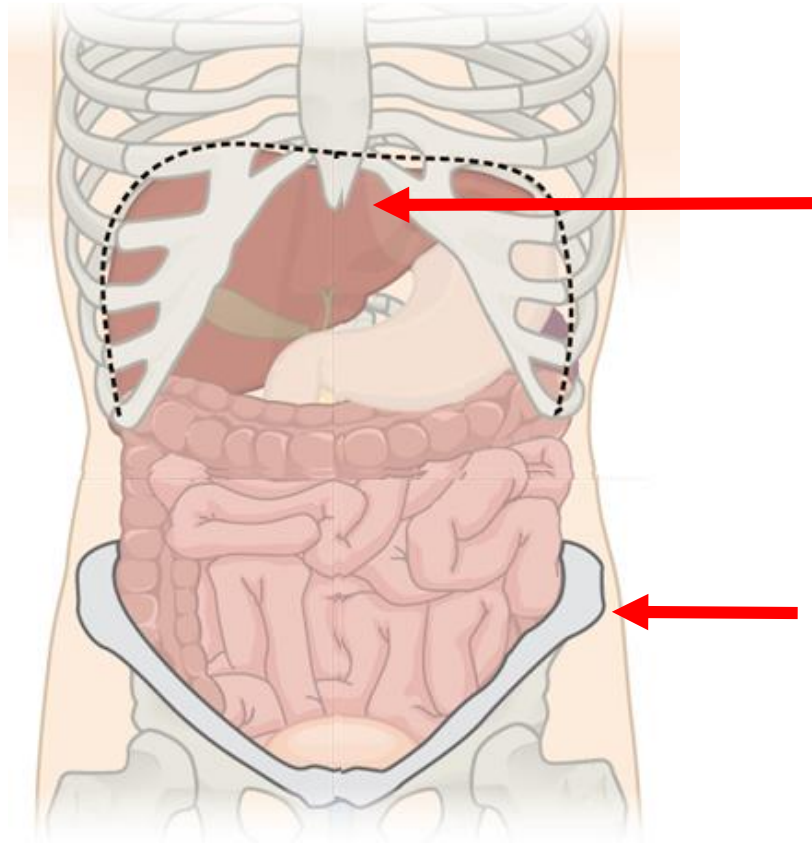


Vorbereitung patiënt

- Prehydratatie: per os, IV (+/- 500 ml vocht over 30 min.)
- IV-leiding voor tracer en evt. Lasix
- Patiënt laten plassen net voor het onderzoek:
 - ✓ geen tegendruk van de blaas die de spontane afloop hindert
 - ✓ langere dynamische fase mogelijk
- Sonde?

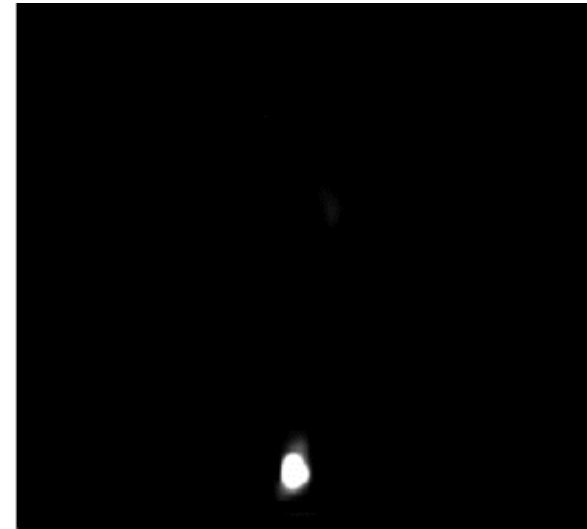
Positionering

volwassene



kind

Inzoomen



Vorbereiding kind



- Sedatie: Dexdor intranasaal
- Algemene anesthesie: enkel zo strikt nodig

Start van het onderzoek

- Positionering is blind; detector posterior (tenzij aberrante ligging)
- Nieren zijn belangrijkste, blaas is bonus.
- Tracer zoveel mogelijk in bolus, zeker voor transplantnier
- Injectie met driewegkraan en direct aansluitend doorspoelen
- Start acquisitie samen met/direct na tracerinjectie (voor in nier)
- **Tijdens de eerste minuut mag er evt. nog geschoven worden zodat nieren bovenaan in beeld staan**

Verloop van het onderzoek

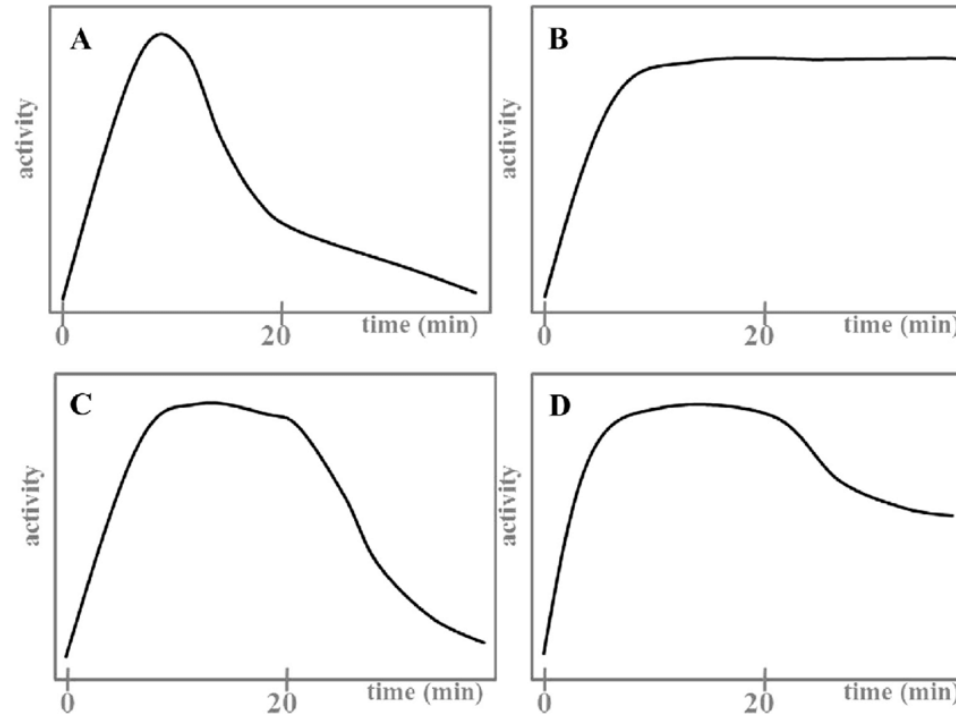
- Start acquisitie samen met/direct na tracerinjectie (voor in nier)
- Tijdens de eerste minuut mag er evt. nog geschoven worden zodat nieren bovenaan in beeld staan
- Dynamische beelden
- Evt. Lasix
- Belang postmictie/postgravitatiebeeld

Interpretatie

- Hoofddoel is kijken of de nier goed afloopt
- De nier heeft 4 kansen om af te lopen:
spontaan, na Lasix, na mictie, of laattijdig.

Interpretatie

- Mogelijk renogram:

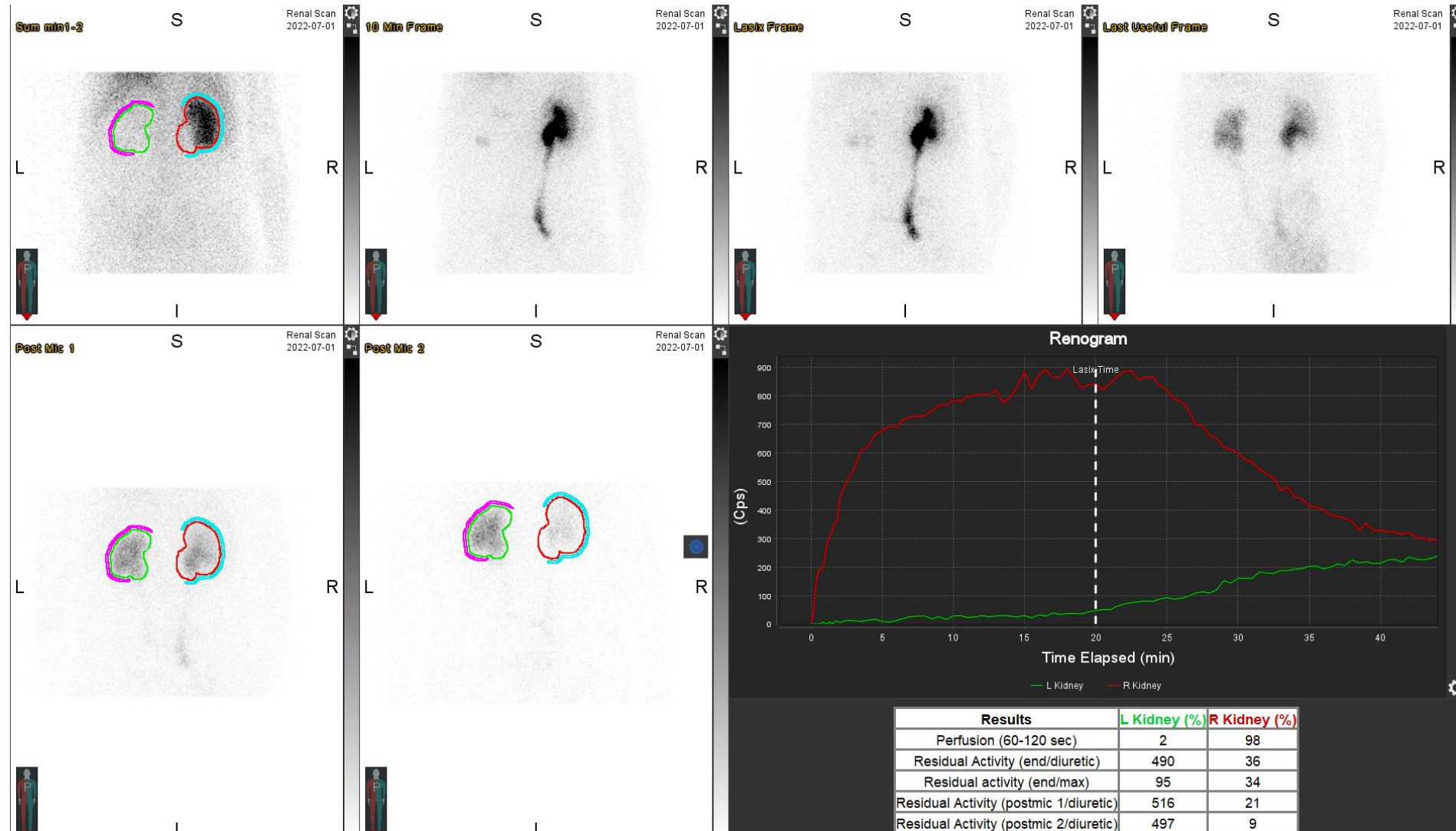


- Berekenen van tijdstippen (T_{max} , $T_{1/2}$)... nut?

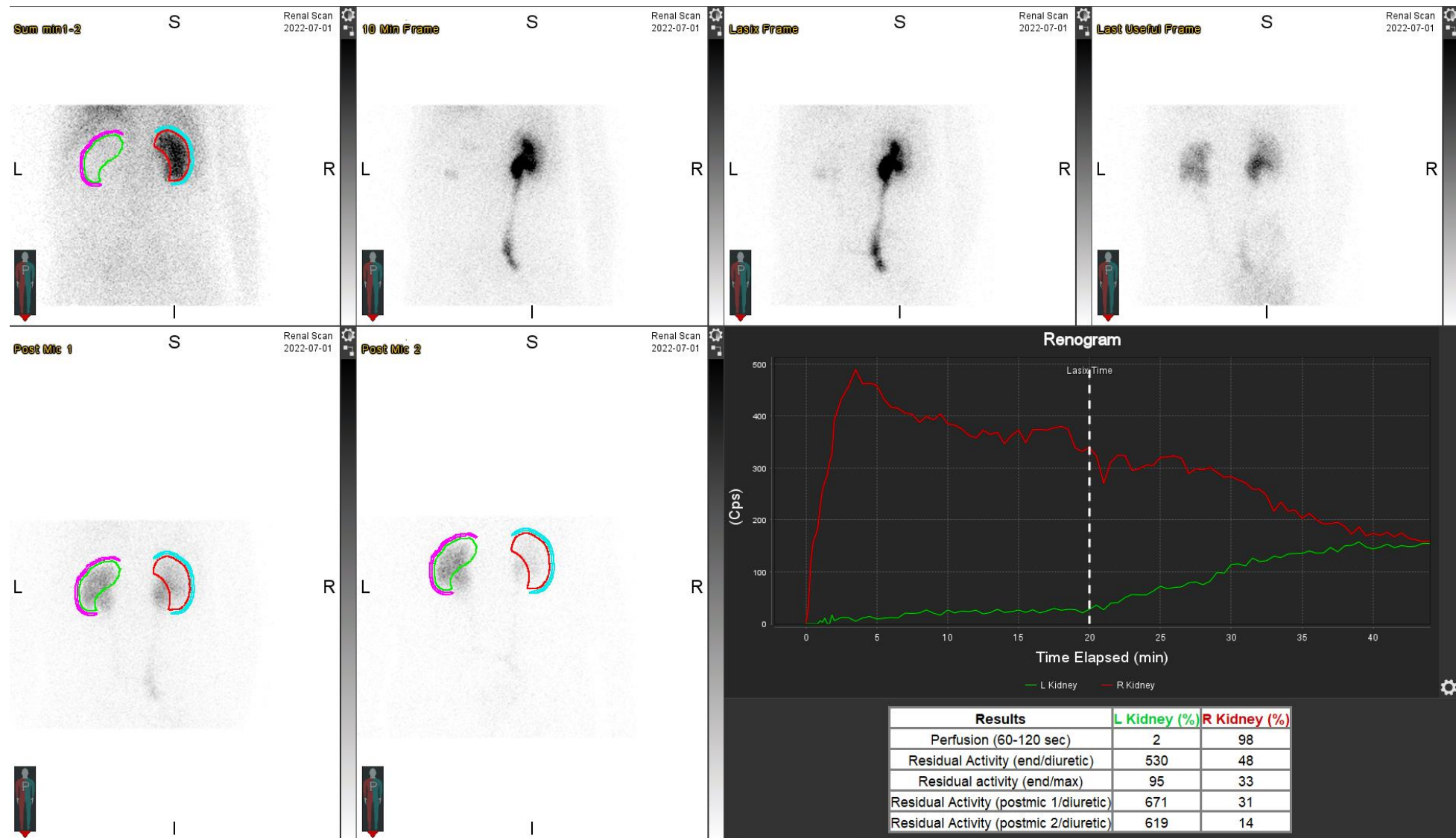
Belang van ROIs

- Veel variaties in literatuur van nier-ROI (enkel parenchym, met pyelon, met pyelon en evt. gedilateerde ureter) en achtergrond (banaan rond de nier, driehoekje onder de nier)
- Renogram wordt bepaald door waar de ROIs worden getekend

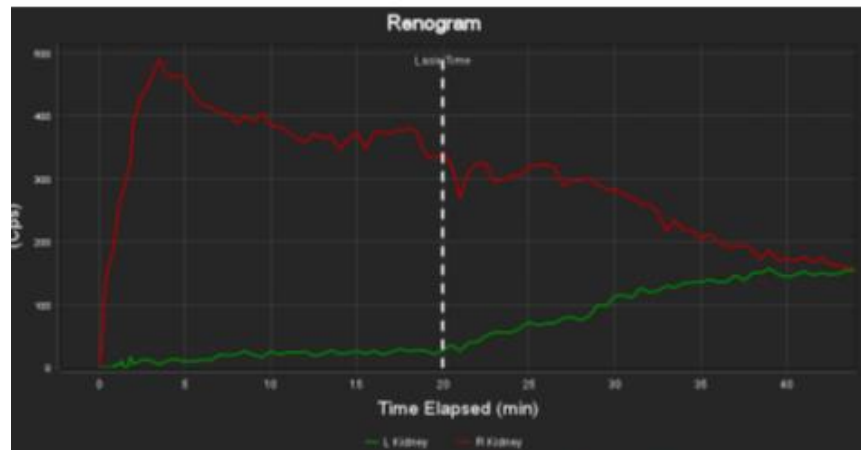
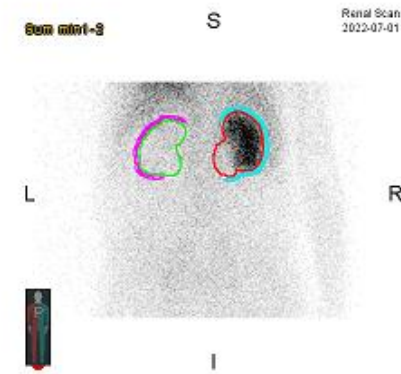
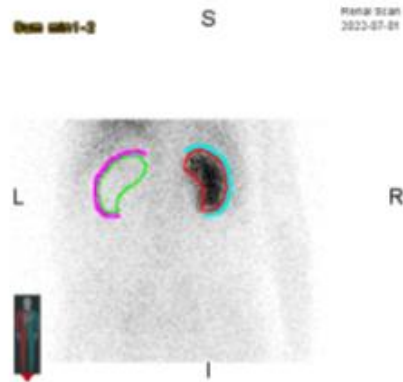
Hetzelfde onderzoek met andere ROIs



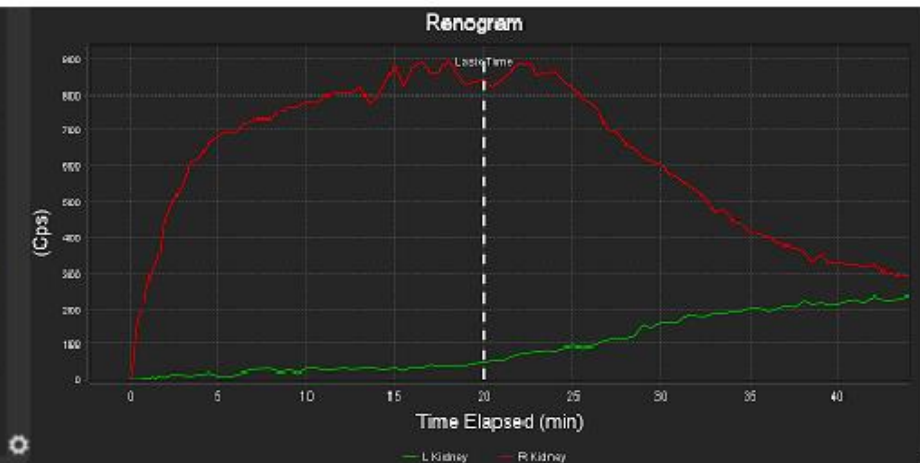
Hetzelfde onderzoek met andere ROIs



Hetzelfde onderzoek met andere ROIs



Results	L Kidney (%)	R Kidney (%)
Perfusion (60-120 sec)	2	98
Residual Activity (end/diuretic)	530	48
Residual activity (end/max)	95	33
Residual Activity (postmic 1/diuretic)	671	31
Residual Activity (postmic 2/diuretic)	619	14

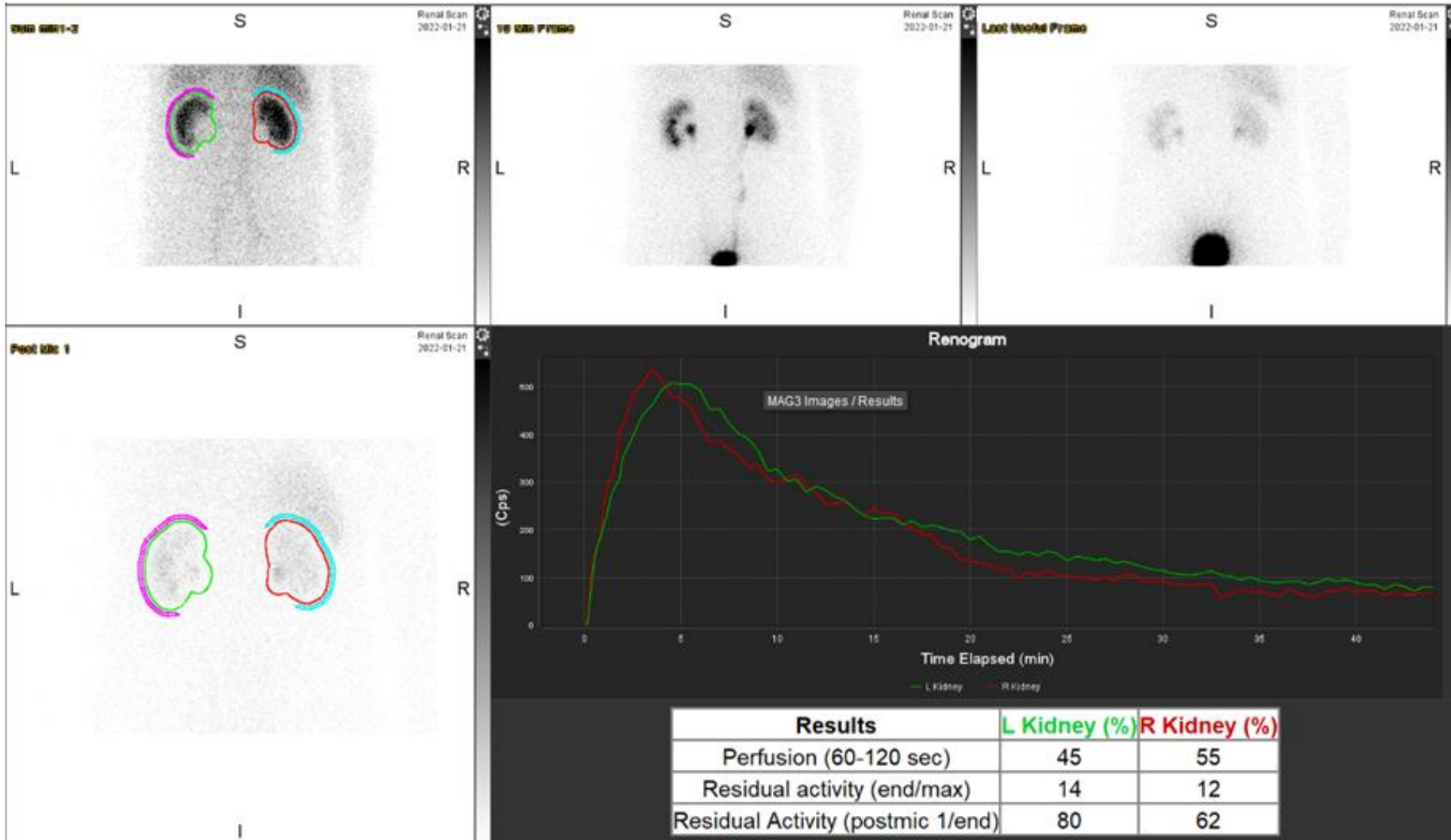


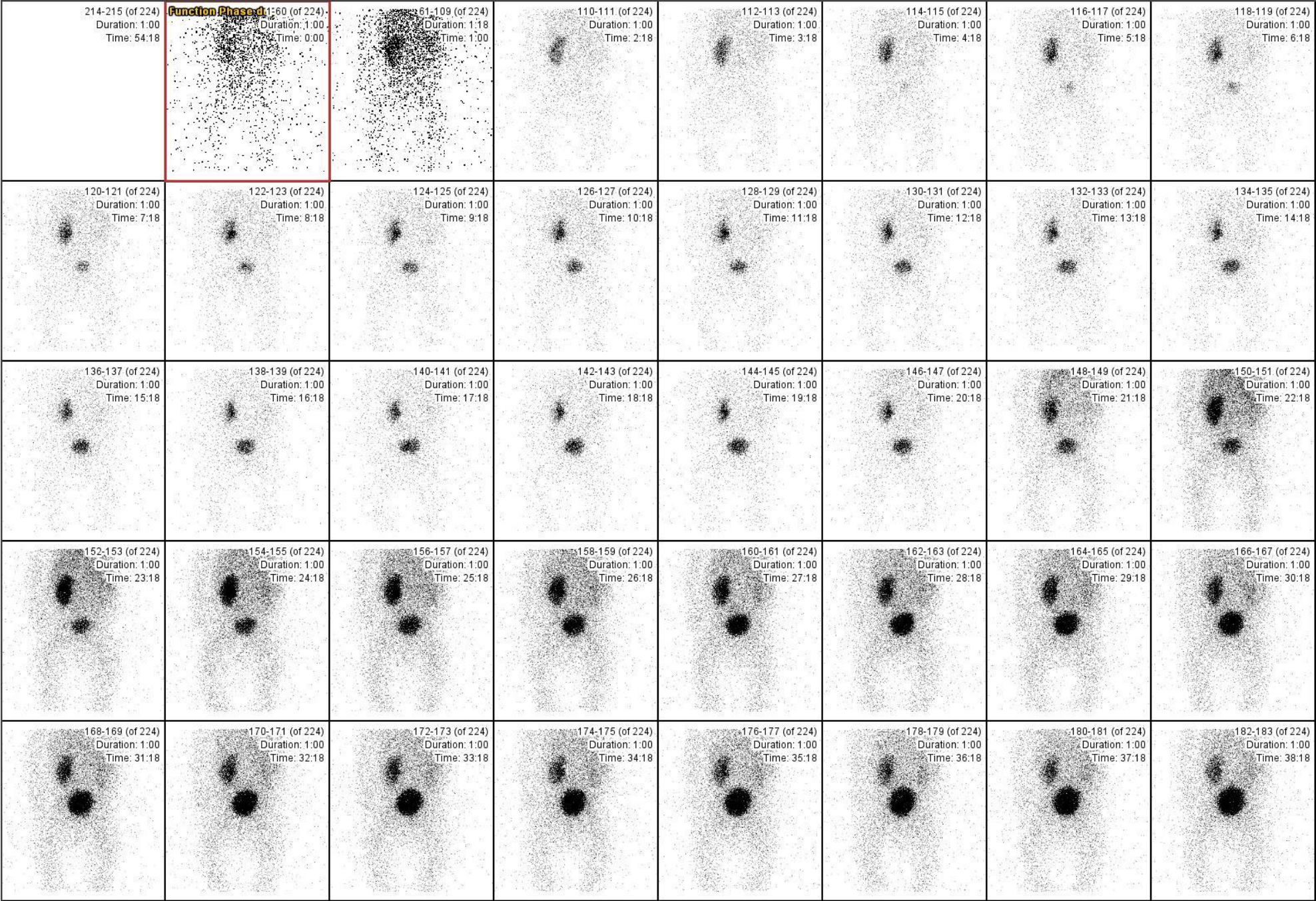
Results	L Kidney (%)	R Kidney (%)
Perfusion (60-120 sec)	2	98
Residual Activity (end/diuretic)	490	36
Residual activity (end/max)	95	34
Residual Activity (postmic 1/diuretic)	516	21
Residual Activity (postmic 2/diuretic)	497	9

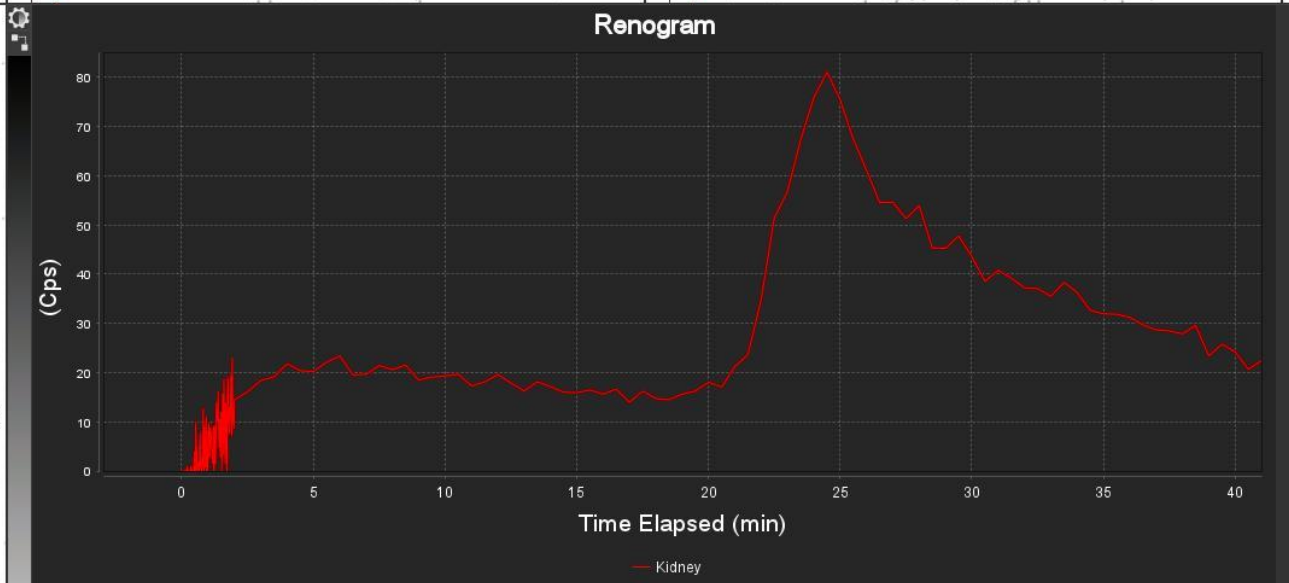
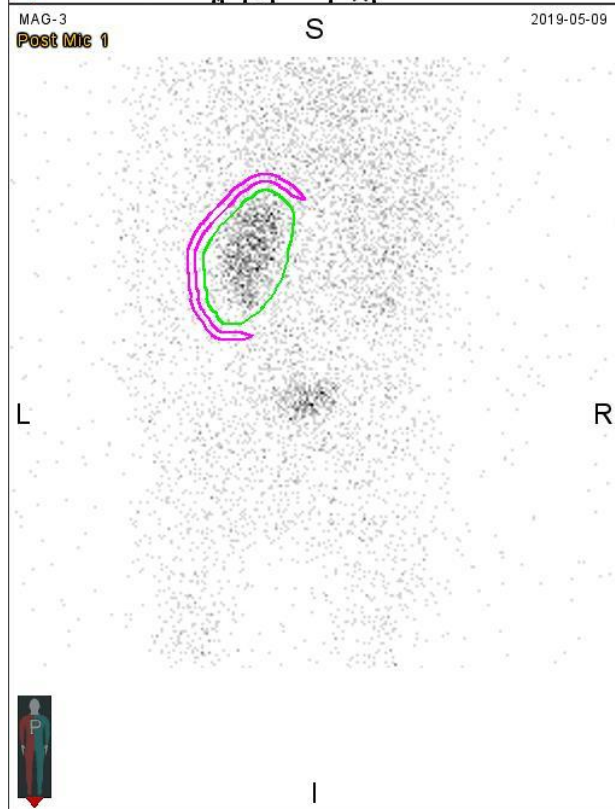
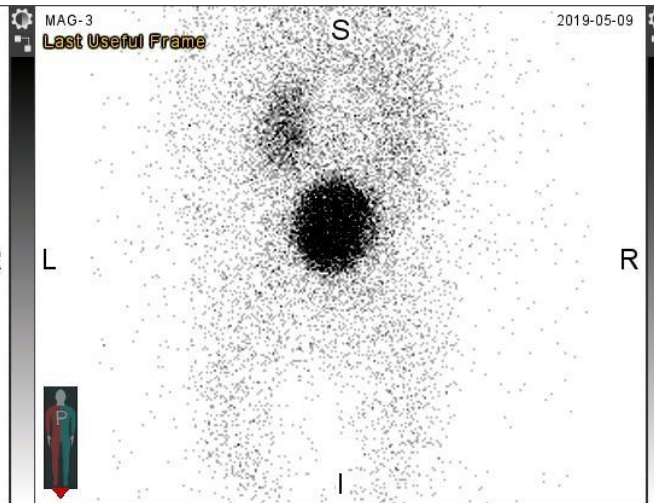
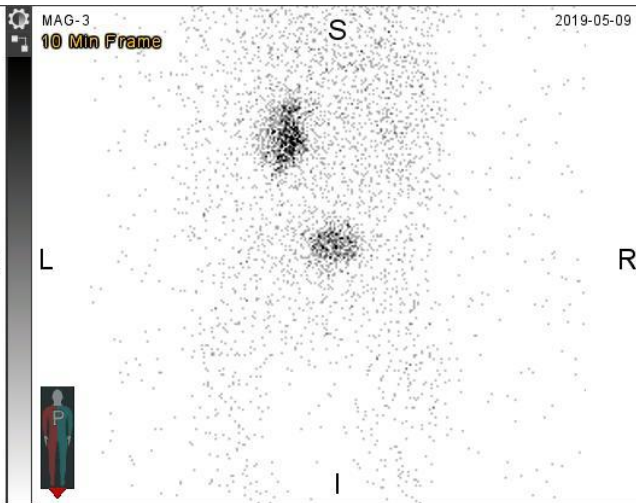
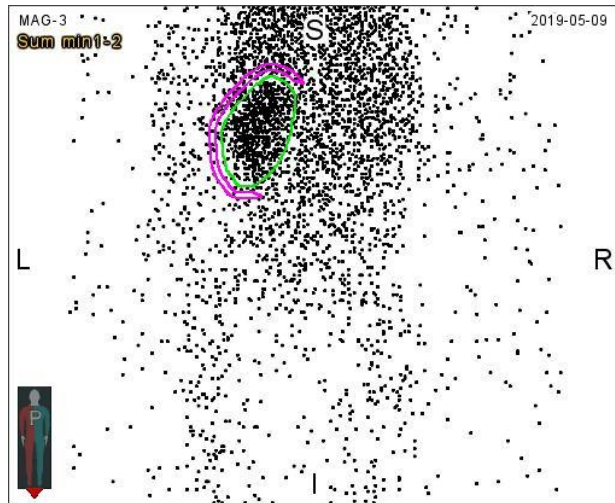
Evaluatie van transplantnier: meestal MAG-3

- Ligging: anterieur in de fossa → anteriorbeeld !
- Urologische complicaties:
 - ✓ (partiële) afsluiting van de nierarterie thv. de anastomose
 - ✓ Lekkage van de ureter
 - ✓ Obstructie van de ureter
- Nefrologische complicaties:
 - ✓ Acute tubulusnecrose (veroorzaakt door zuurstoftekort voorafgaand aan de transplantatie): normale perfusie en parenchymfase, maar er wordt geen tracer uitgescheiden (curve daalt niet)
 - ✓ Afstoting: renogram in de 3 fasen gestoord

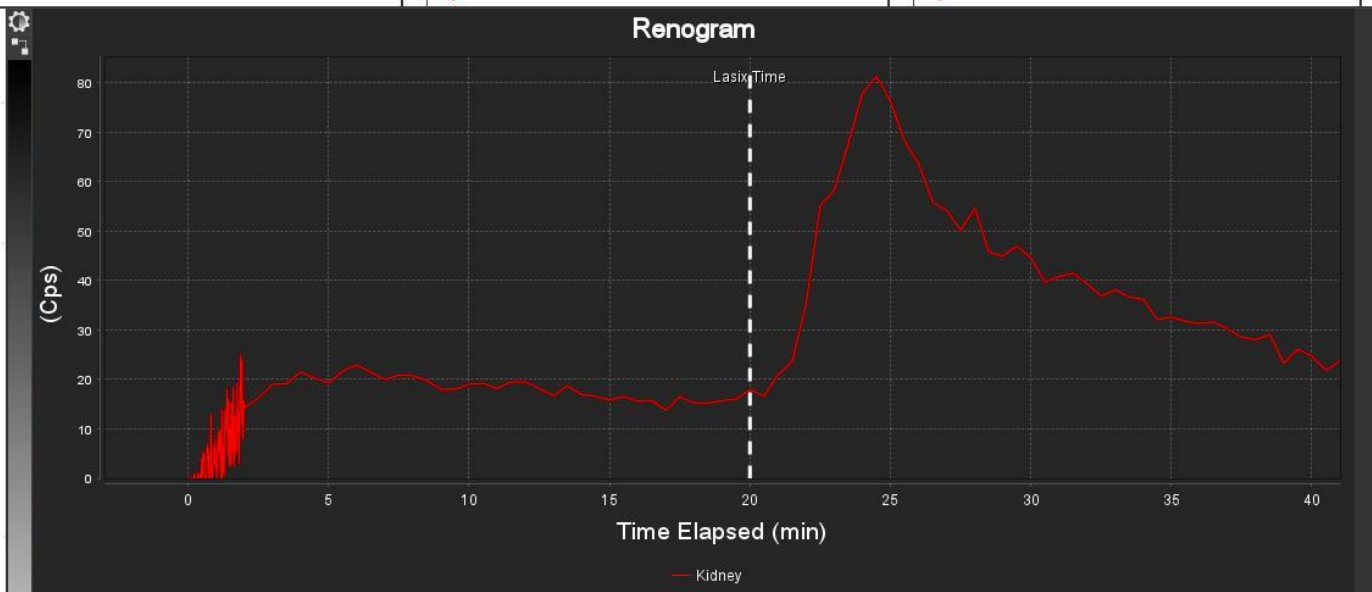
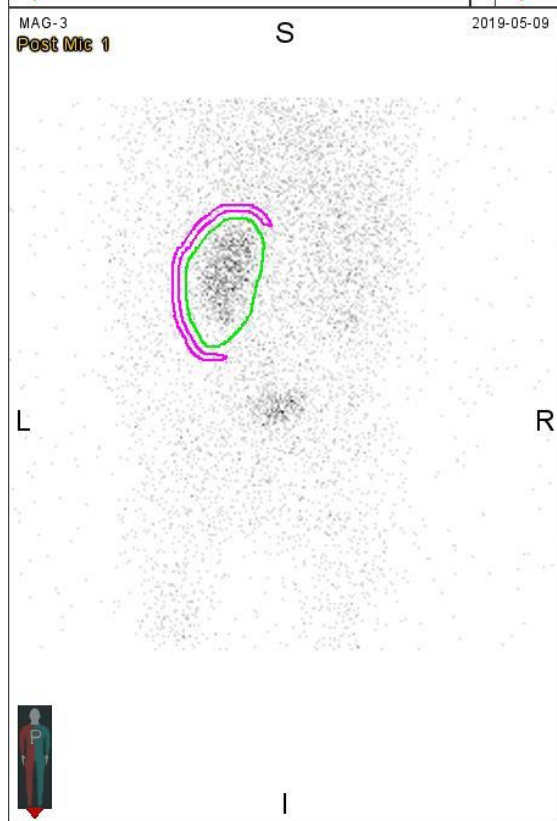
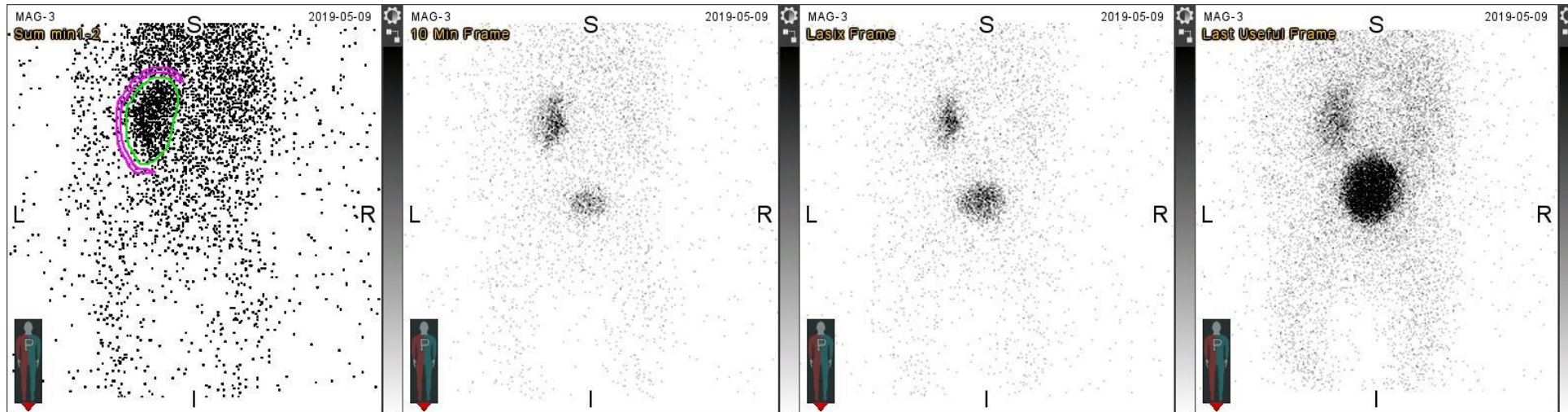
Voorbeelden







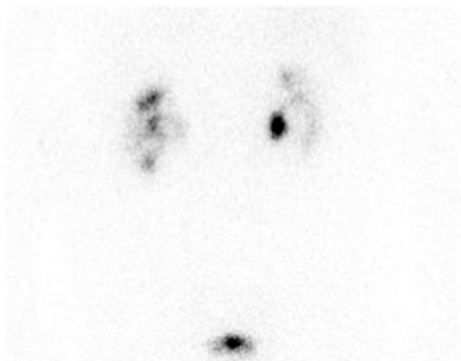
Results	Kidney (%)
Residual activity (postmic 1/end)	83
Residual activity (end/max)	30



Results	Kidney (%)
Residual Activity (end/diuretic)	140
Residual activity (end/max)	30
Residual Activity (postmic 1/diuretic)	110

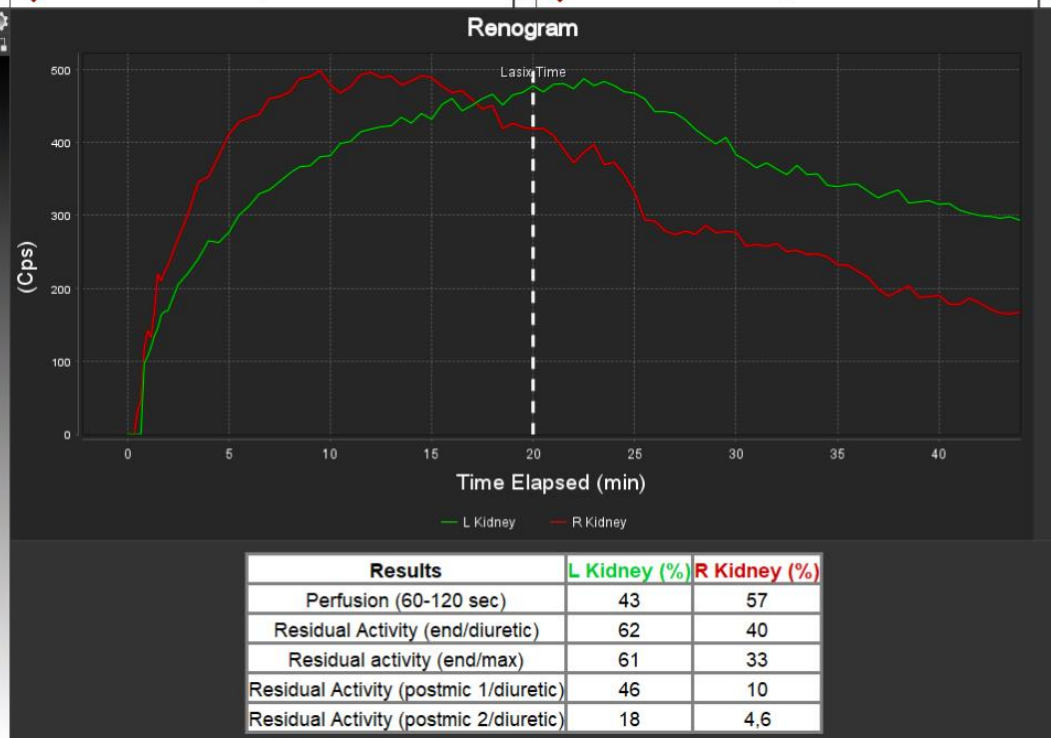
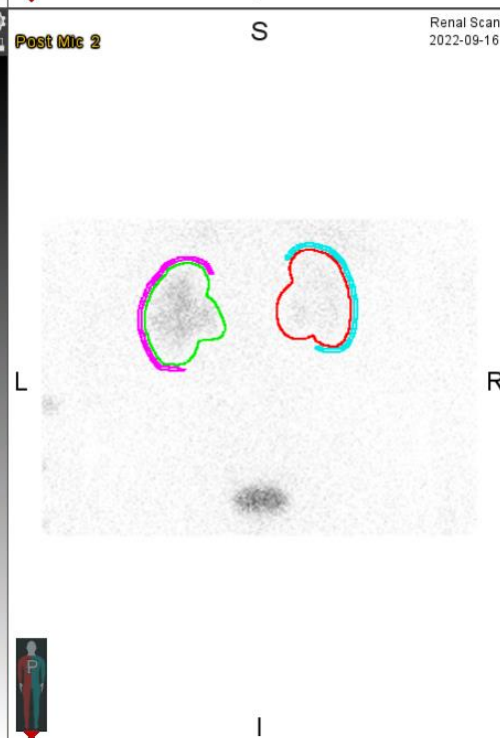
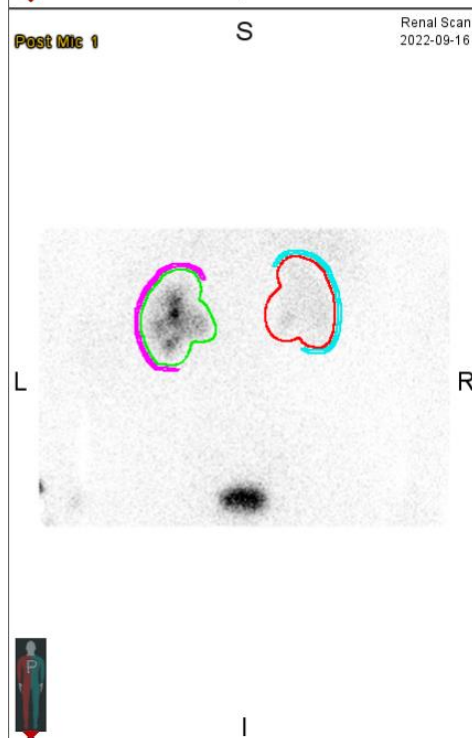
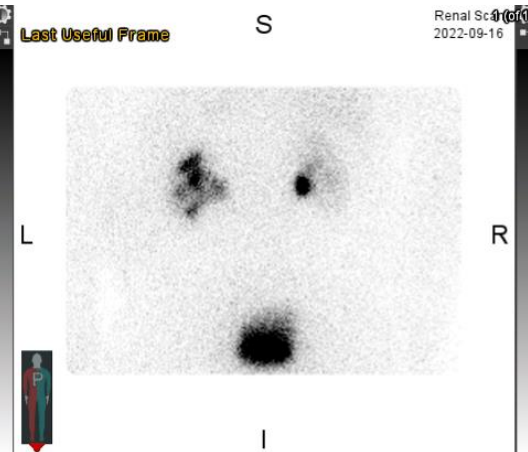
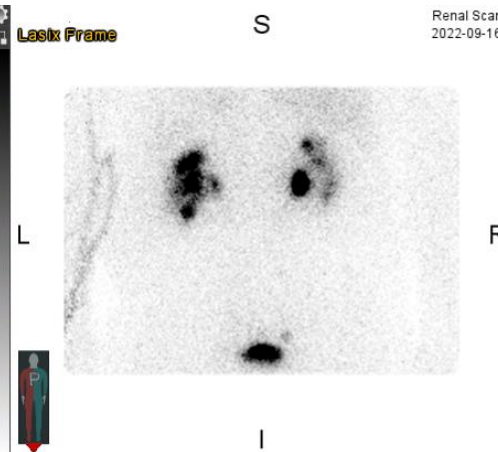
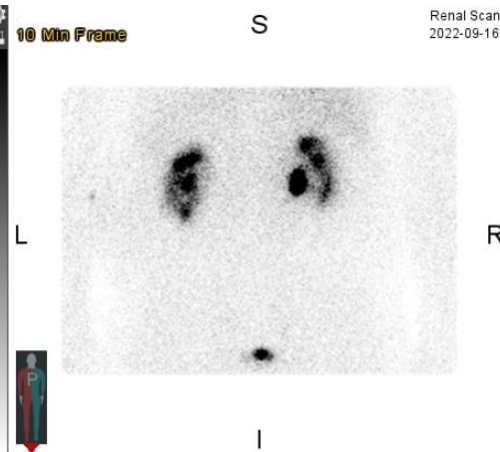
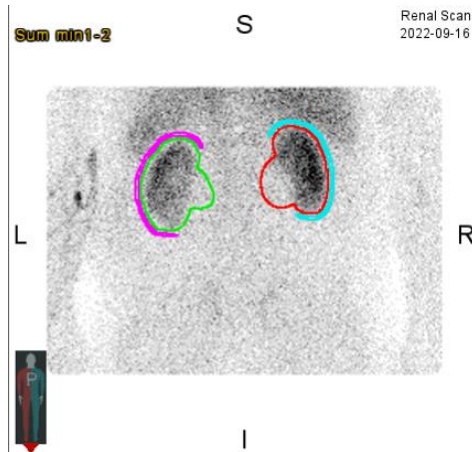
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4 (of 12) Duration: 0:10 Time: 0:30	5 (of 12) Duration: 0:10 Time: 0:40	6 (of 12) Duration: 0:10 Time: 0:50	7 (of 12) Duration: 0:10 Time: 1:00
8 (of 12) Duration: 0:10 Time: 1:10	9 (of 12) Duration: 0:10 Time: 1:20	10 (of 12) Duration: 0:10 Time: 1:30	11 (of 12) Duration: 0:10 Time: 1:40

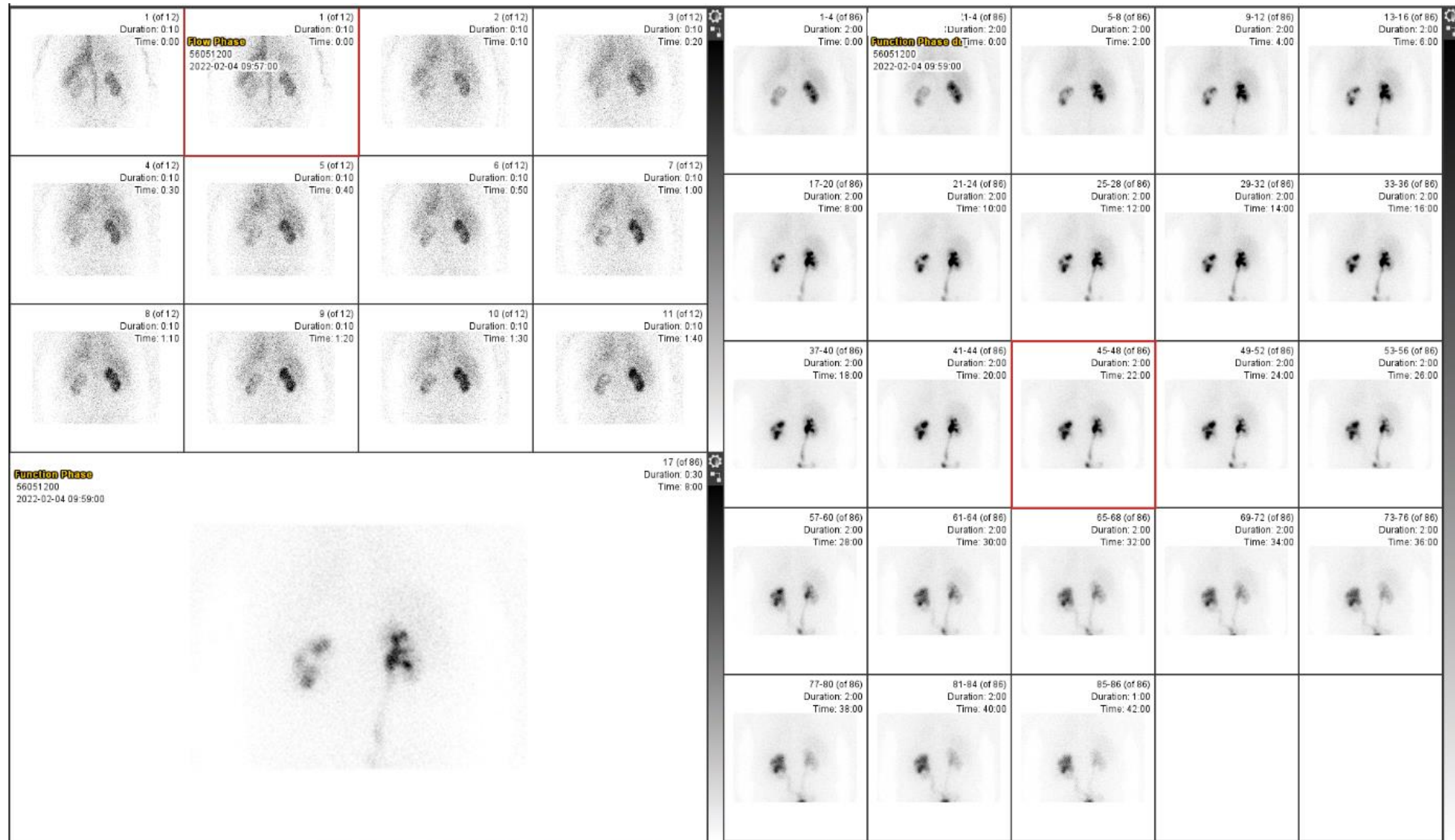
Function Phase
48032104
2022-09-16 09:30:41

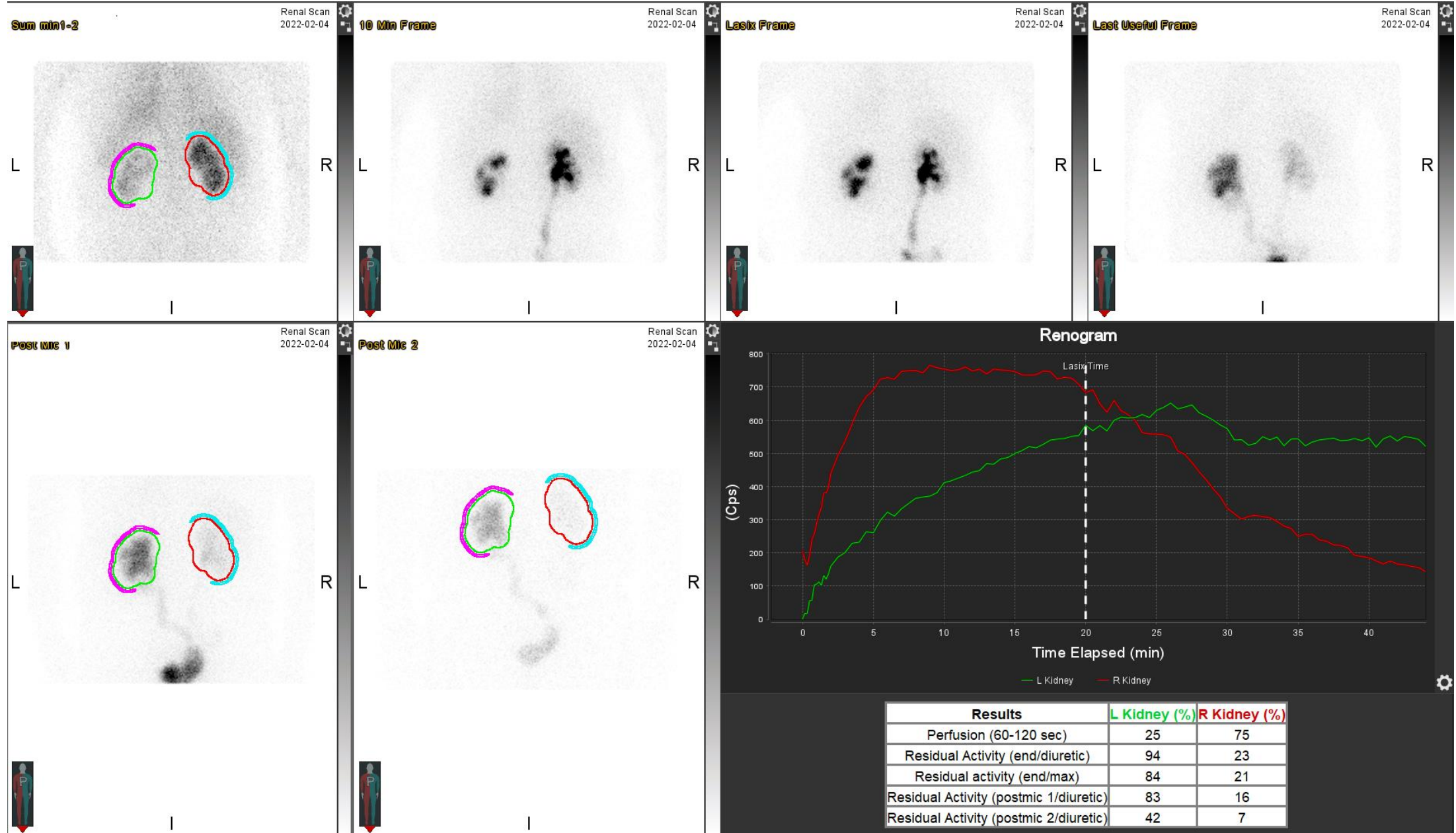


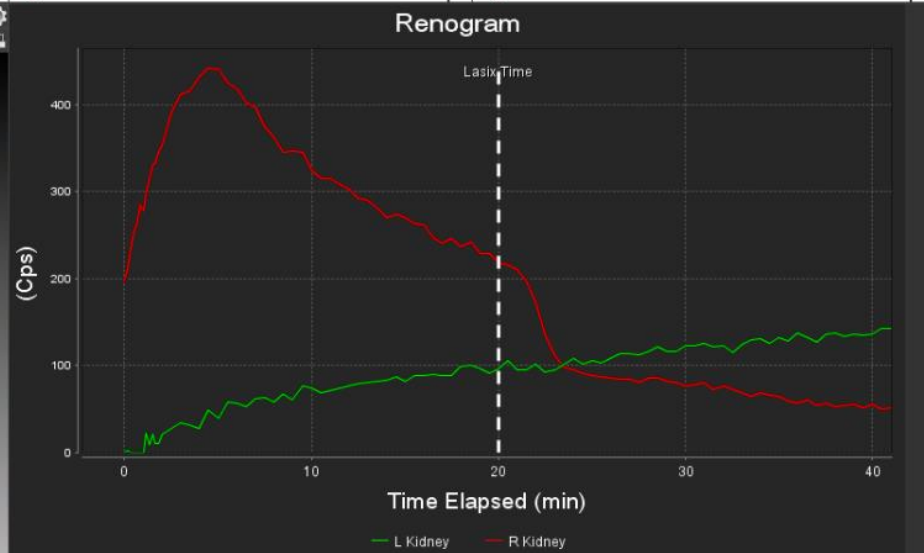
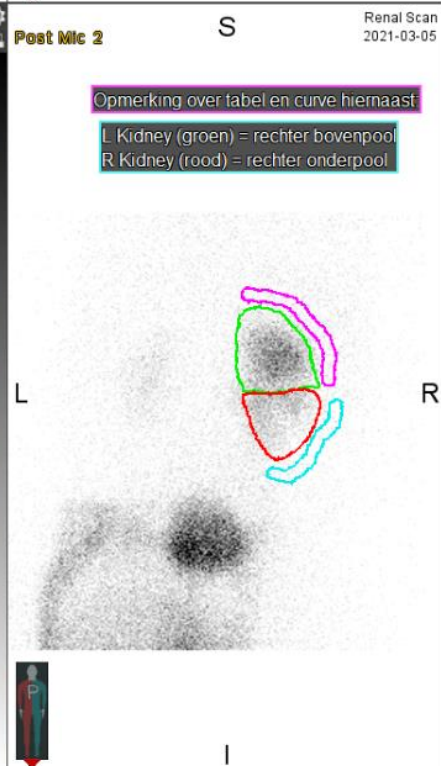
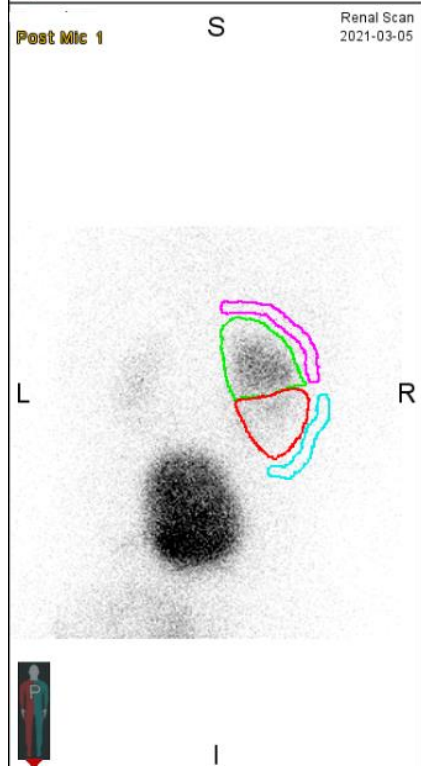
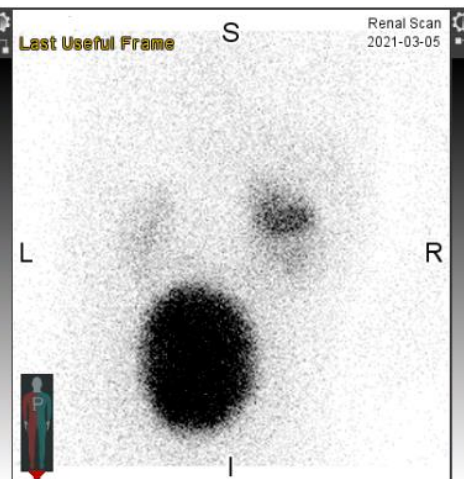
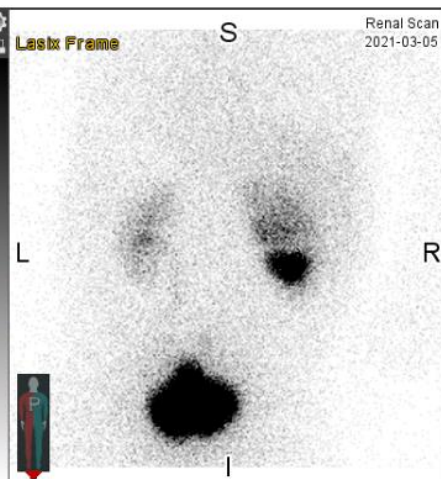
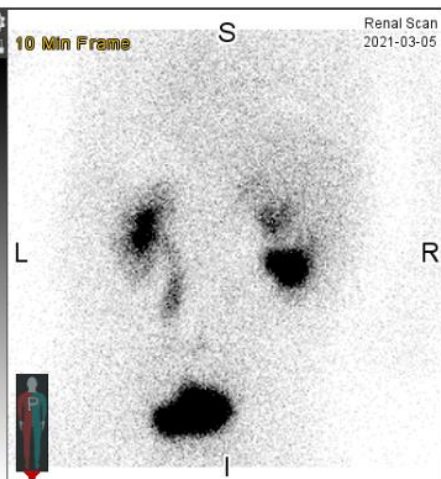
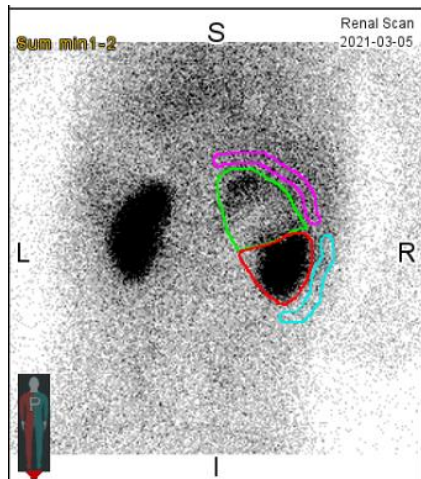
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1-4 (of 86) Duration: 2:00 Time: 0:00	3-6 (of 86) Function Phase 48032104 2022-09-16 09:30:41 Duration: 2:00 Time: 1:00	7-10 (of 86) Duration: 2:00 Time: 3:00	11-14 (of 86) Duration: 2:00 Time: 5:00	15-18 (of 86) Duration: 2:00 Time: 7:00
19-22 (of 86) Duration: 2:00 Time: 9:00	23-26 (of 86) Duration: 2:00 Time: 11:00	27-30 (of 86) Duration: 2:00 Time: 13:00	31-34 (of 86) Duration: 2:00 Time: 15:00	35-38 (of 86) Duration: 2:00 Time: 17:00
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79-82 (of 86) Duration: 2:00 Time: 39:00	83-86 (of 86) Duration: 2:00 Time: 41:00			

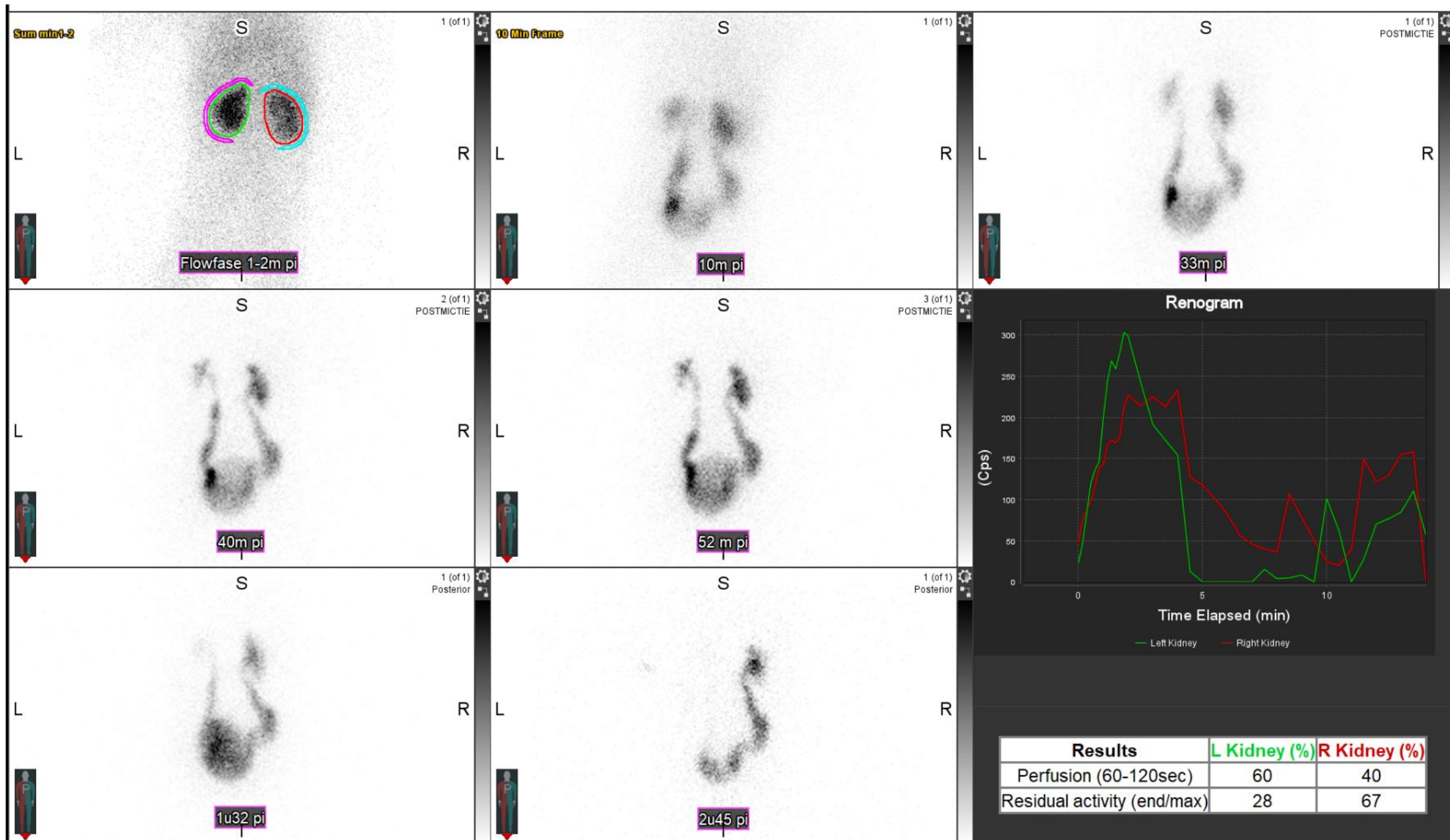


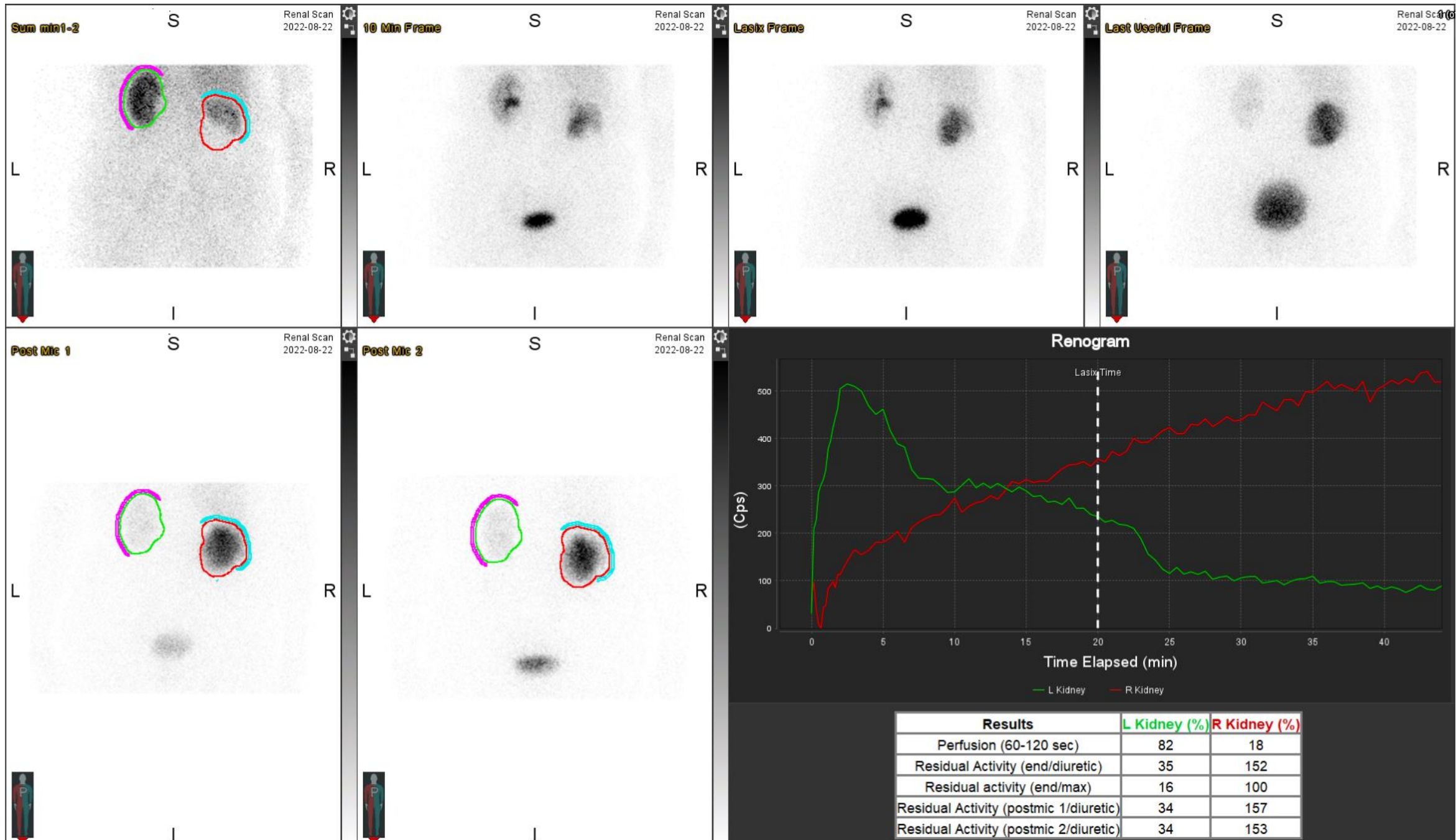






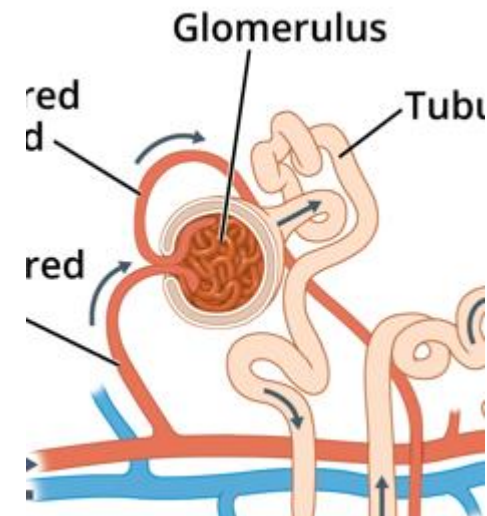
Results	L Kidney (%)	R Kidney (%)
Perfusion (60-120 sec)	4	96
Residual Activity (end/diuretic)	142	25
Residual activity (end/max)	95	12
Residual Activity (postmic 1/diuretic)	141	22
Residual Activity (postmic 2/diuretic)	143	25





GFR-bepaling

Cr51-EDTA, Tc99m-DTPA



GFR-bepaling

- Snelheid van filtering = maat voor nierfunctie
- Kan worden berekend op basis van creatinine, maar is indirect: eGFR
- Kan exact worden gemeten met NucGen onderzoek
- Geen beeldvorming, enkele bloedstalen, meten in dosiscalibrator
- Klassiek Cr51-EDTA; ook literatuur over Tc99m-DTPA met goede congruentie

Nierschorsscintigrafie

DMSA



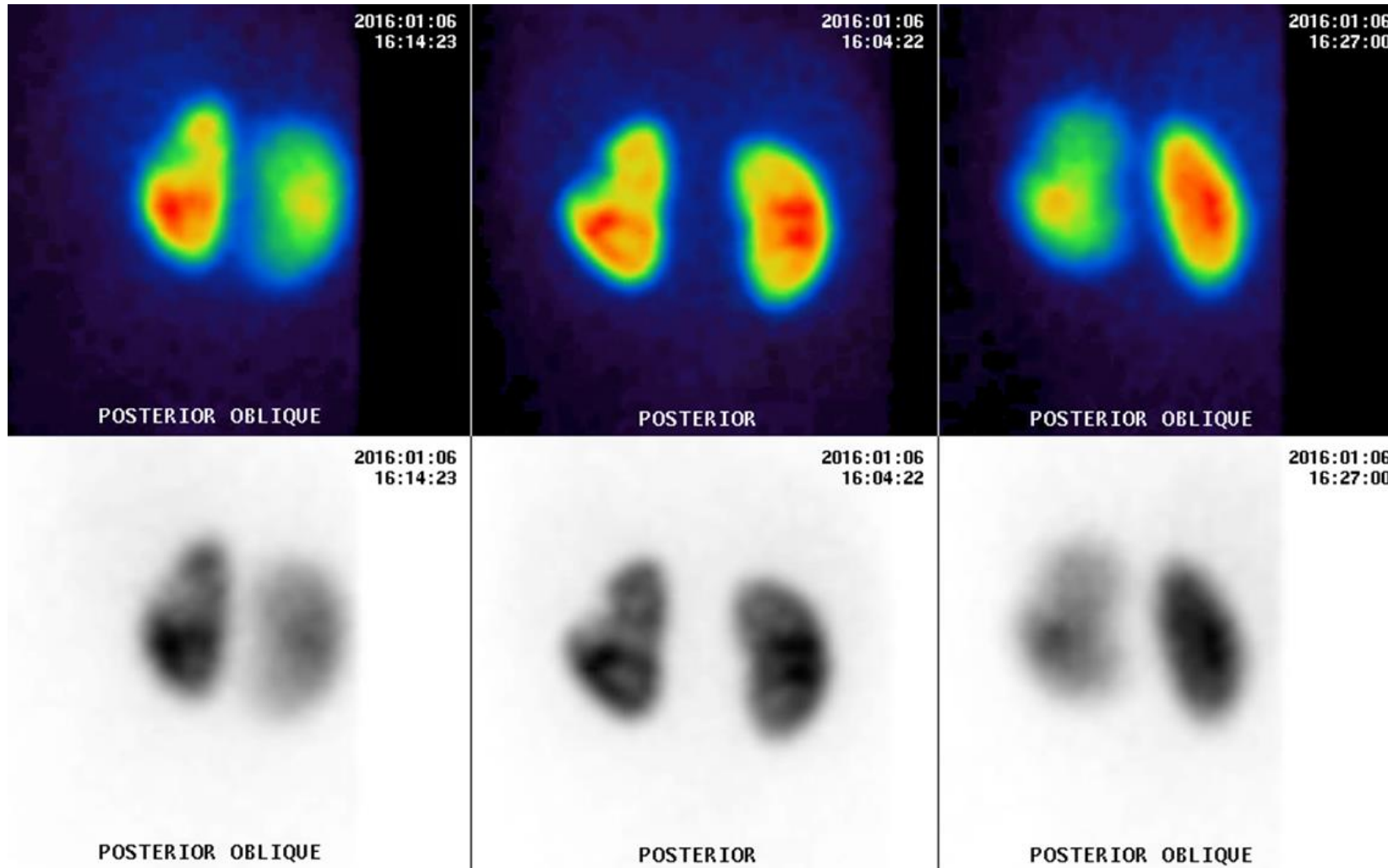
Indicaties

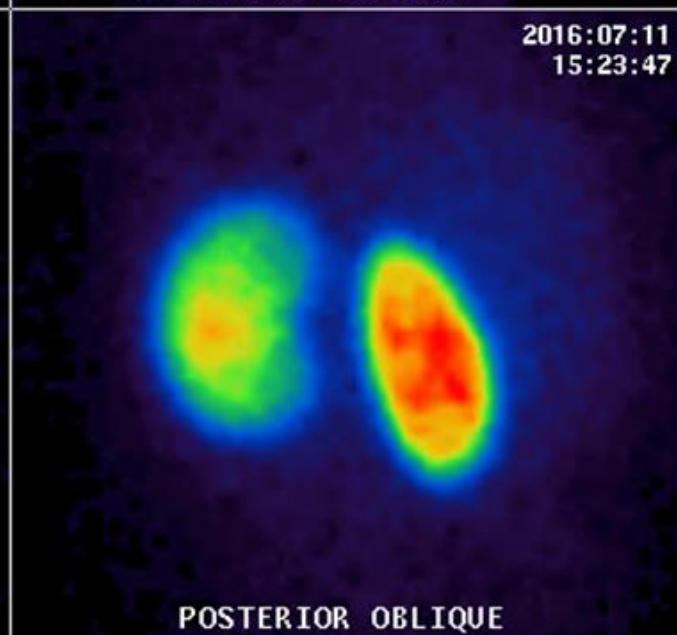
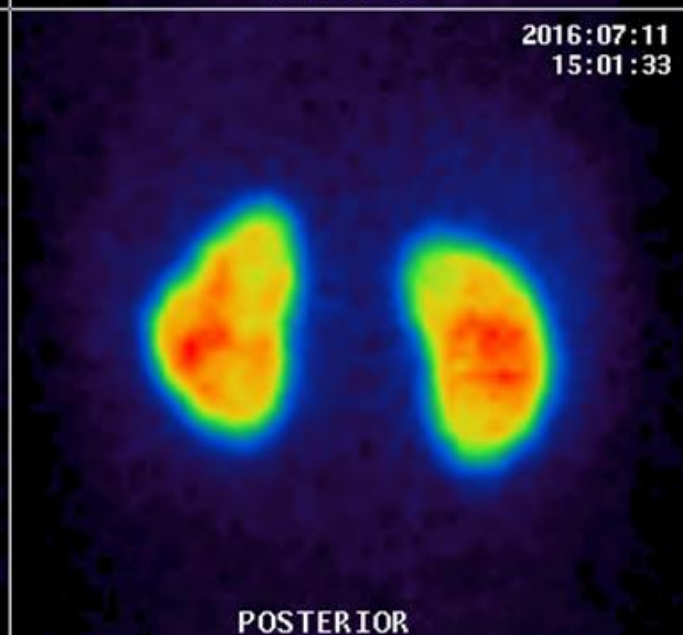
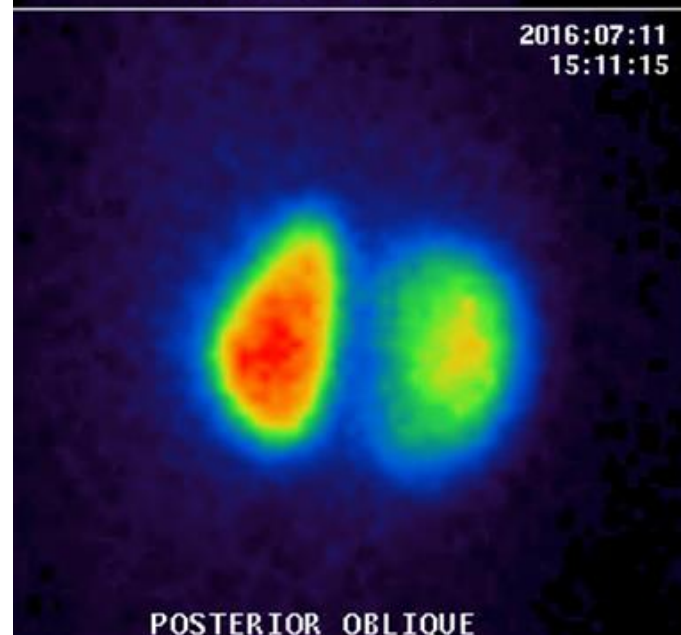
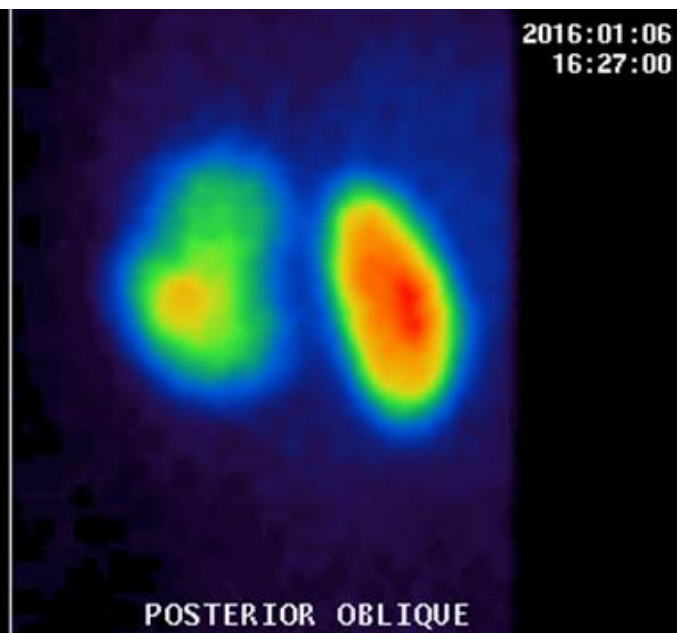
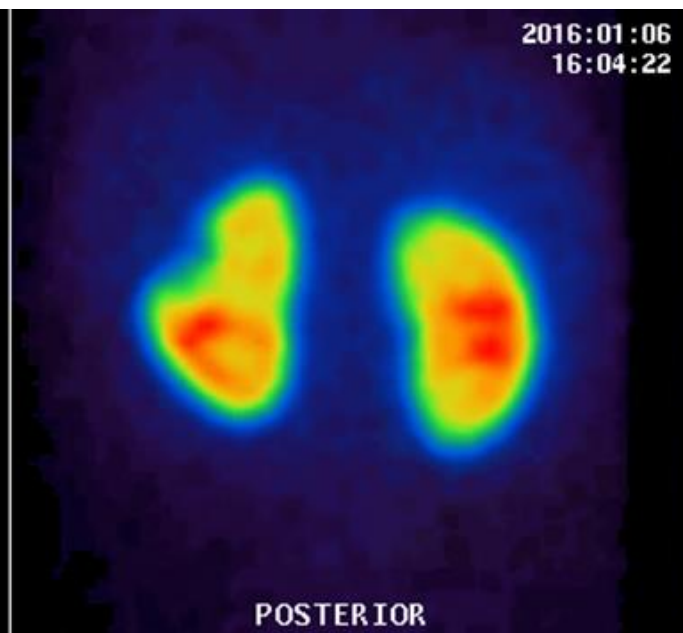
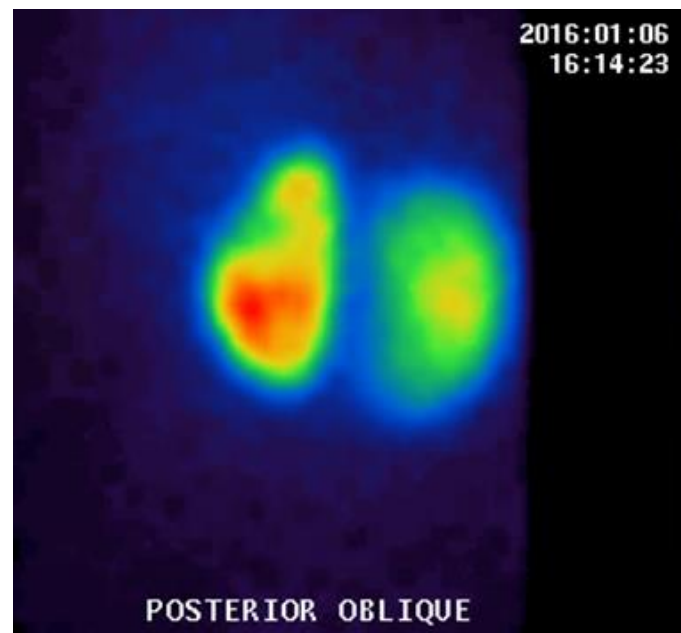
- Visualisatie van lokale defecten of beschadigingen van het parenchym: tijdens of na pyelonefritis
- Visualisatie van functioneel nierweefsel: follow-up bij nieraandoeningen
- Nauwkeurige links-rechts-verdeling

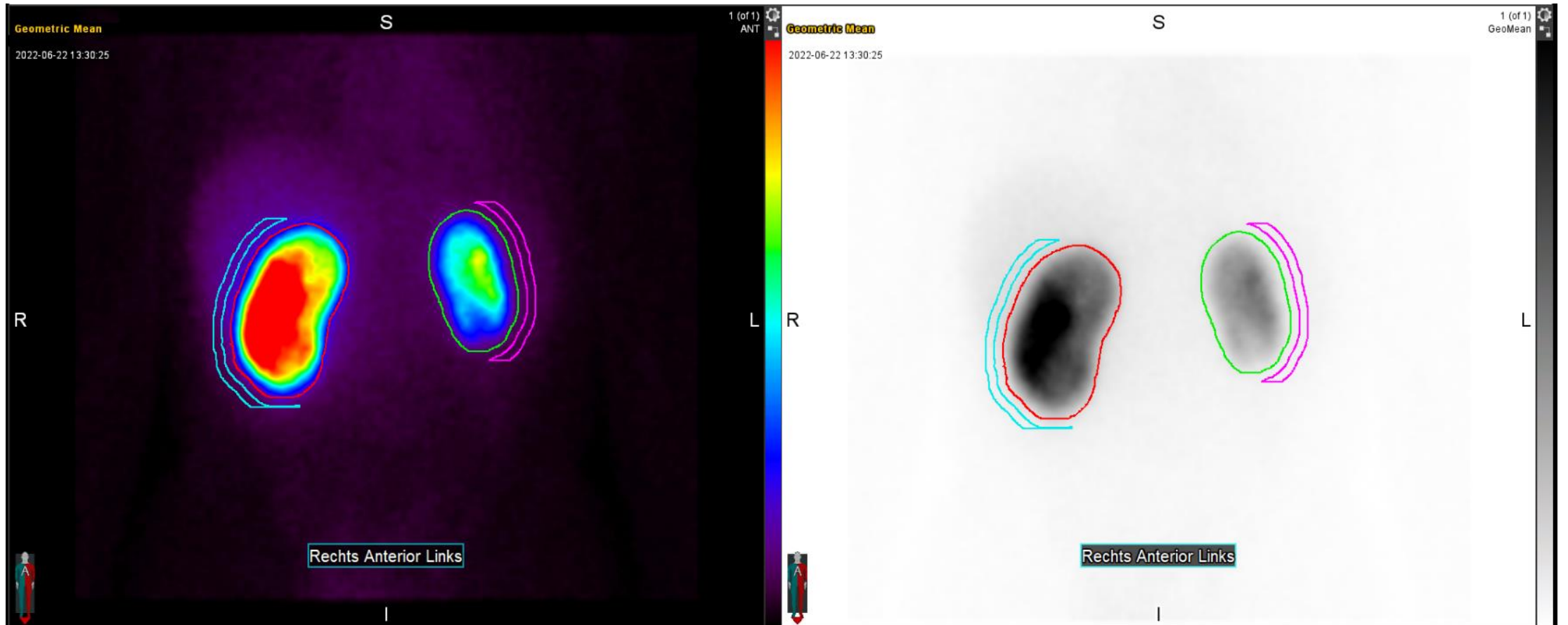
DMSA + beeldvorming

- (DMSA = Dimercapto-Succinic-Acid)
- Ongeveer 50% van de dosis wordt in de tubuluscellen van de nier vastgehouden, en ongeveer 20% wordt over verloop van enkele uren in de urine uitgescheiden (zowel via glomerulaire filtratie als tubulaire opname uit het bloed).
- Statische beelden (2-)4-6u post-injectie
 - Beelden van 5-10 min in Ant-Post, LAO-RPO, RAO-LPO, met beide detectoren
- SPECT (/CT)

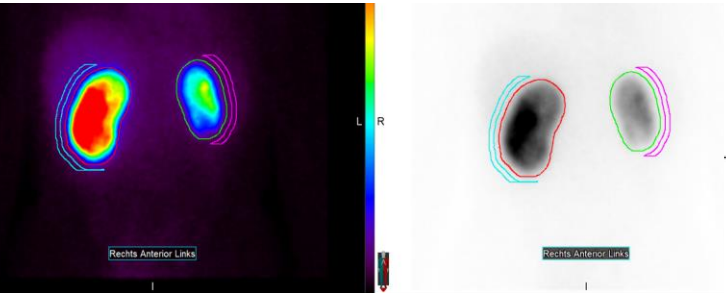
Voorbeelden



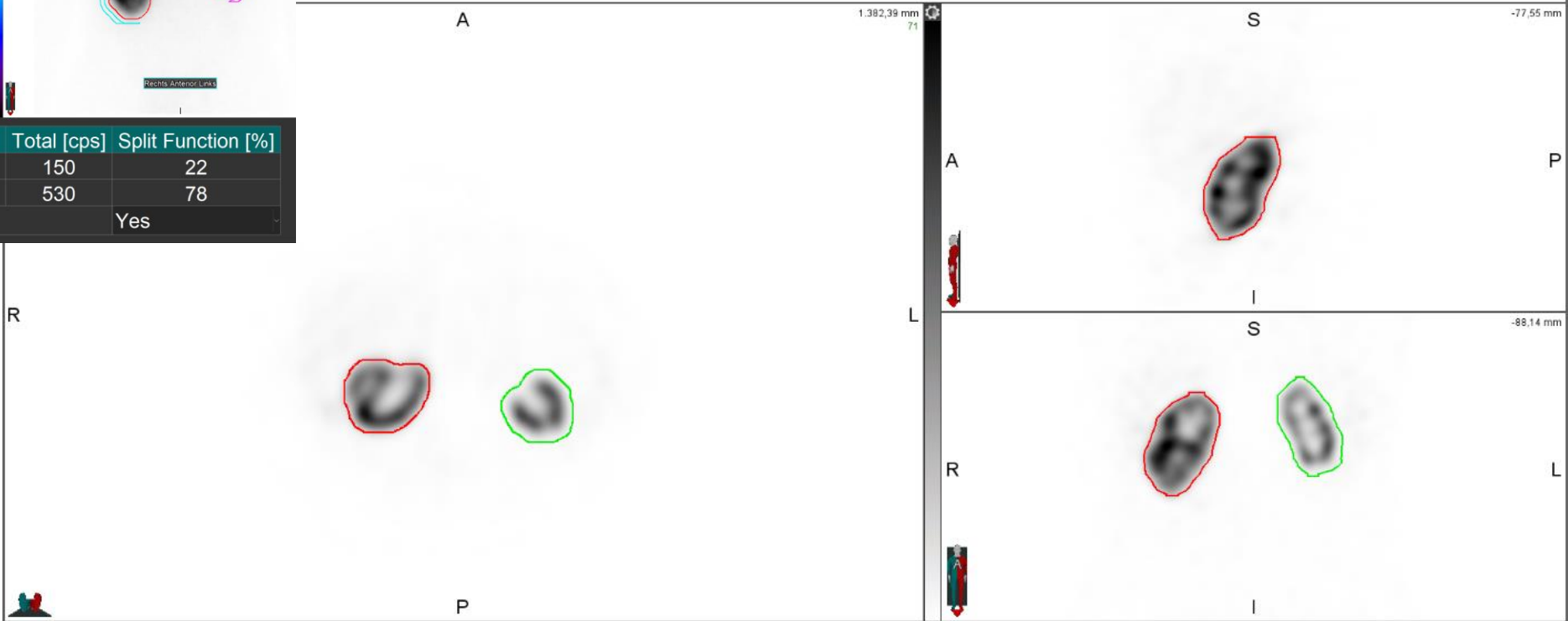




Geometric Mean	Area [cm2]	Total [cps]	Split Function [%]
L Kidney	44	150	22
R Kidney	68	530	78
Background correction			Yes



Geometric Mean	Area [cm2]	Total [cps]	Split Function [%]
L Kidney	44	150	22
R Kidney	68	530	78
Background correction			Yes

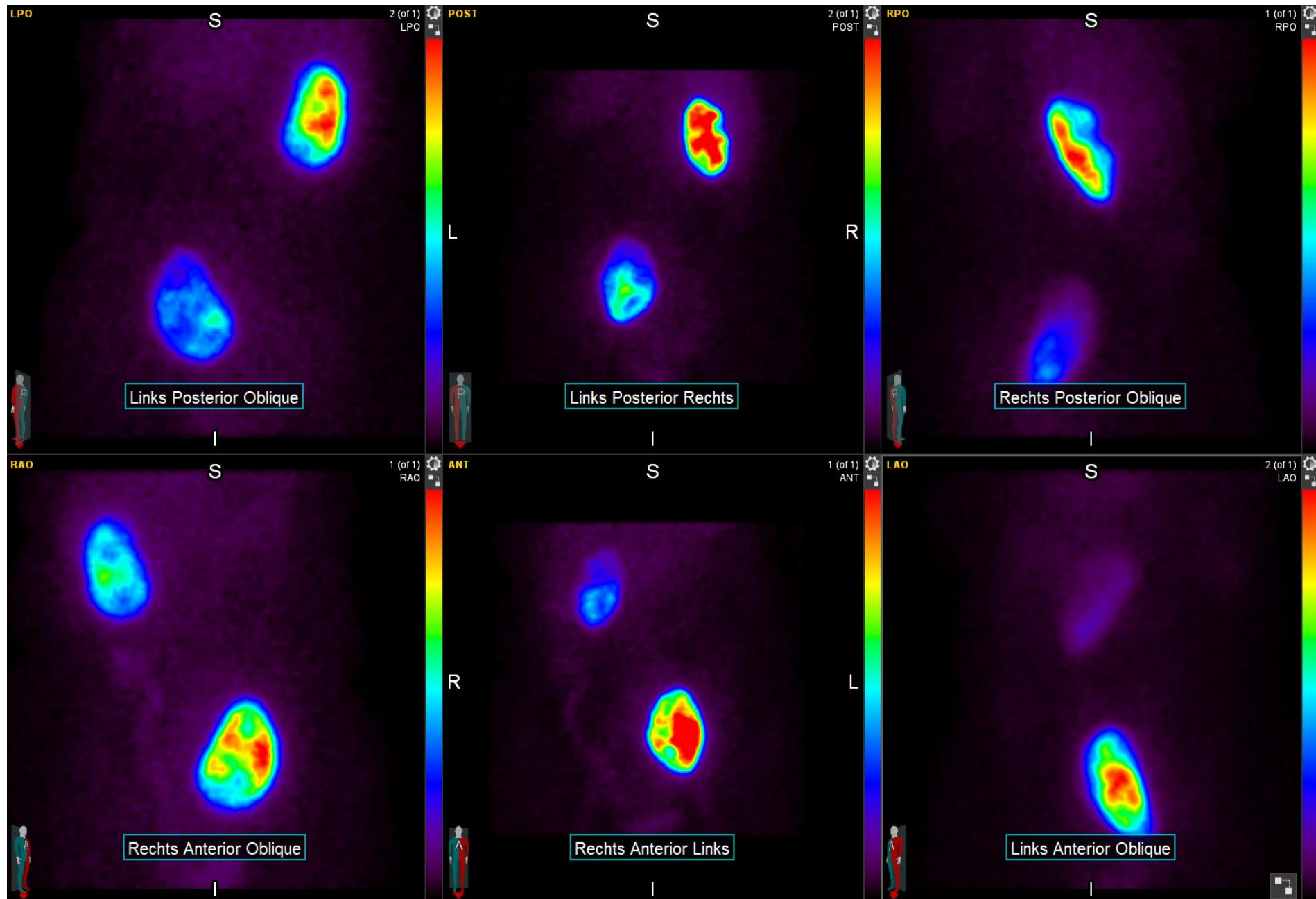


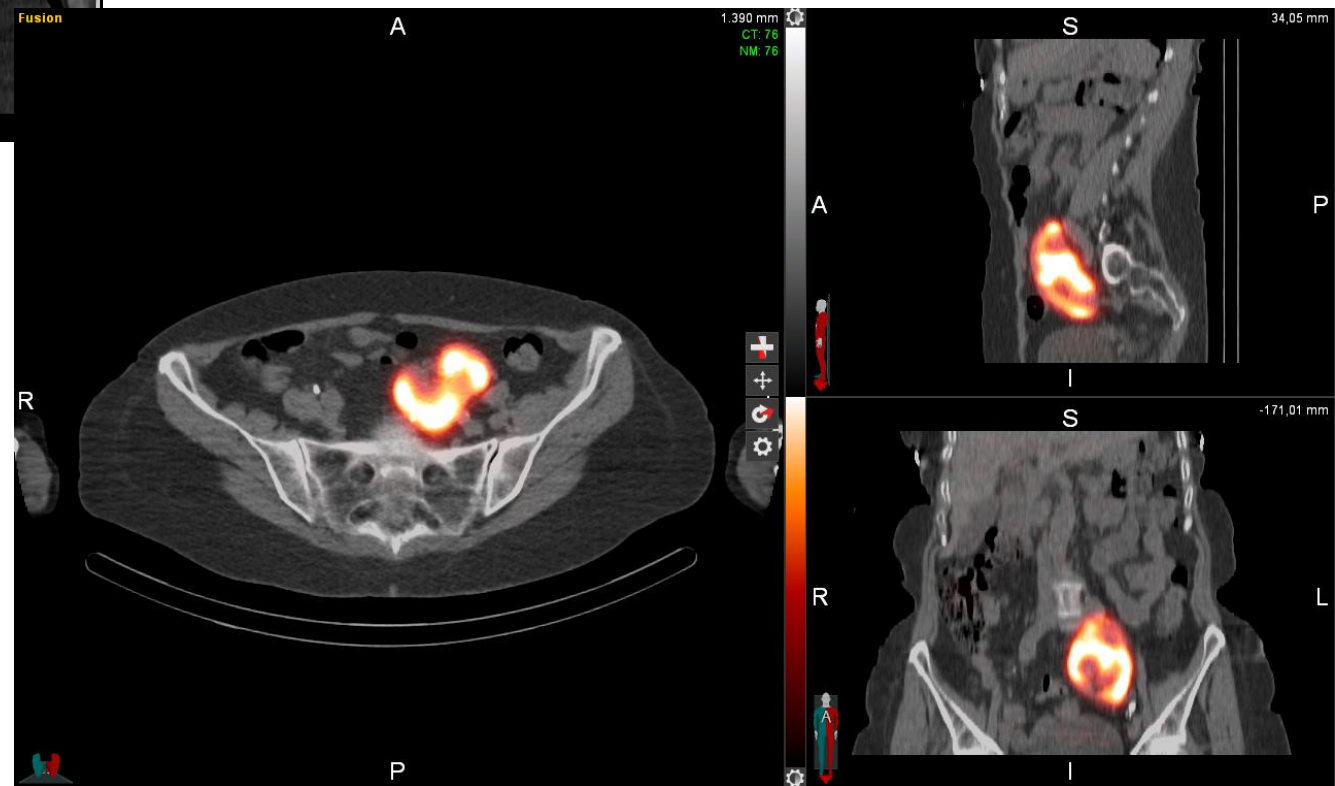
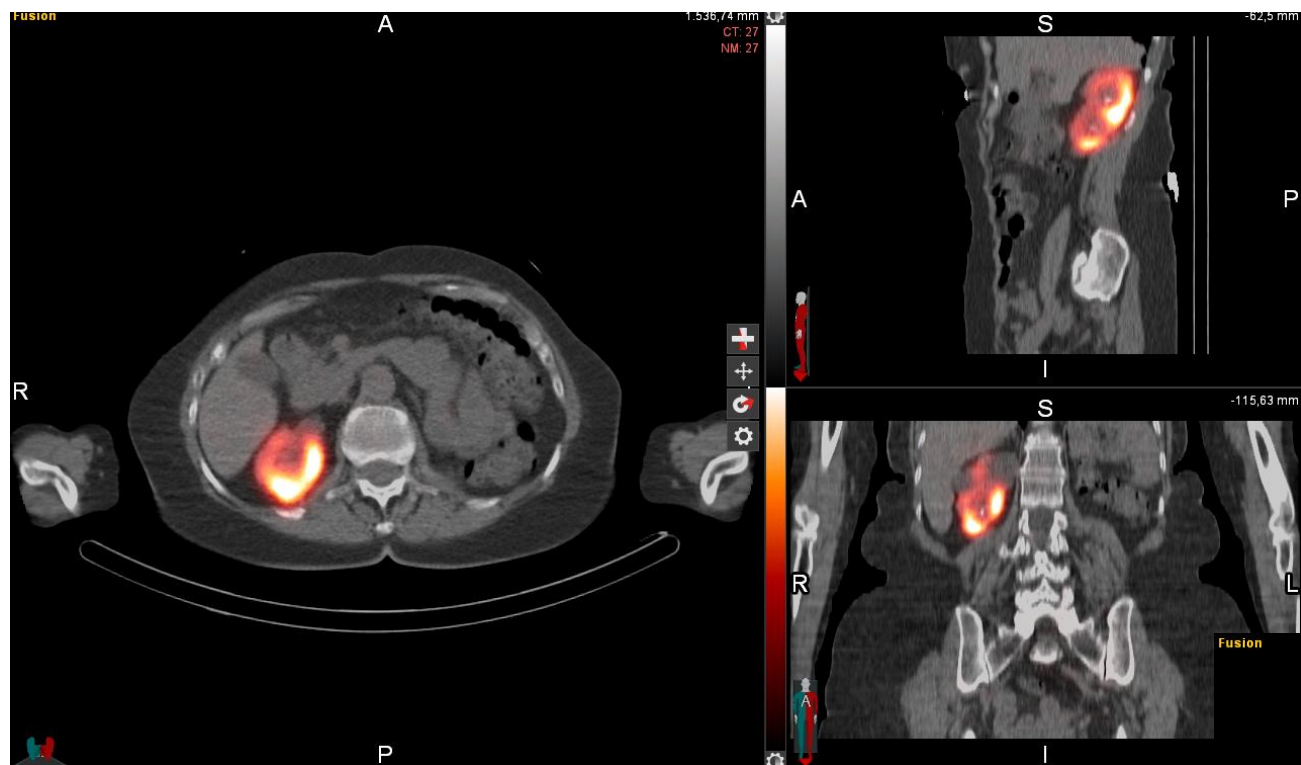
SPECT	Volume [ml]	Total [kCNTS]	Split Function [%]
L Kidney	170	270	24
R Kidney	290	840	76

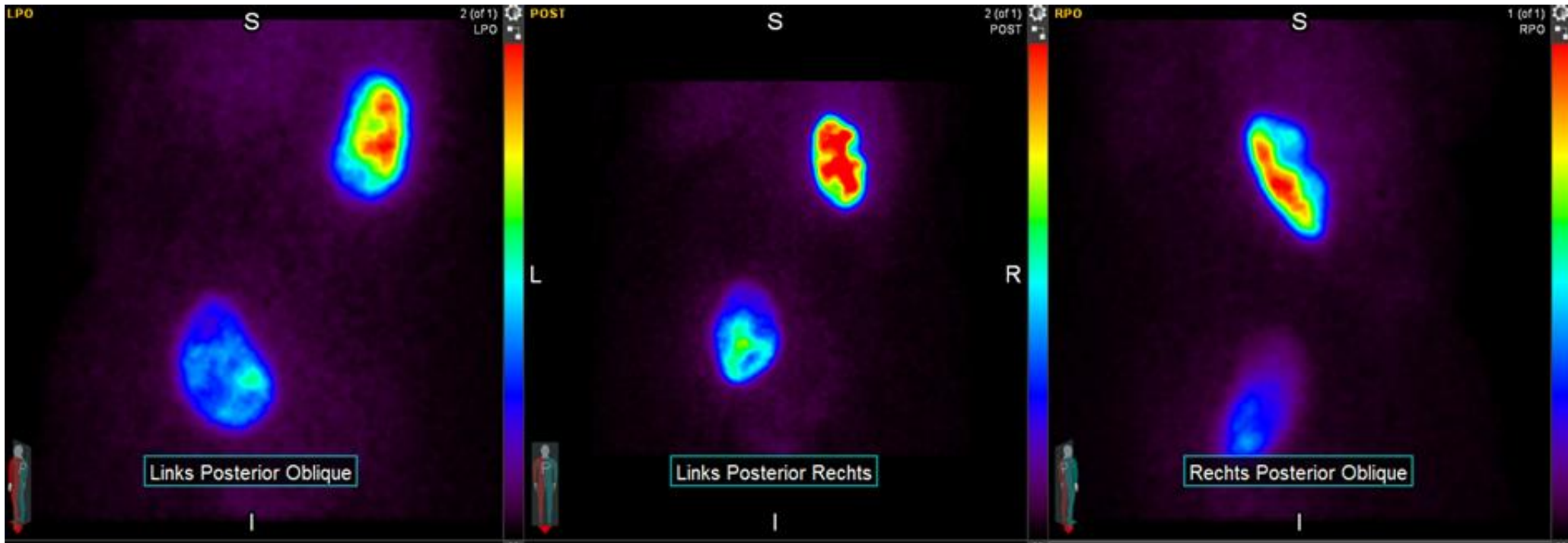
SPECT

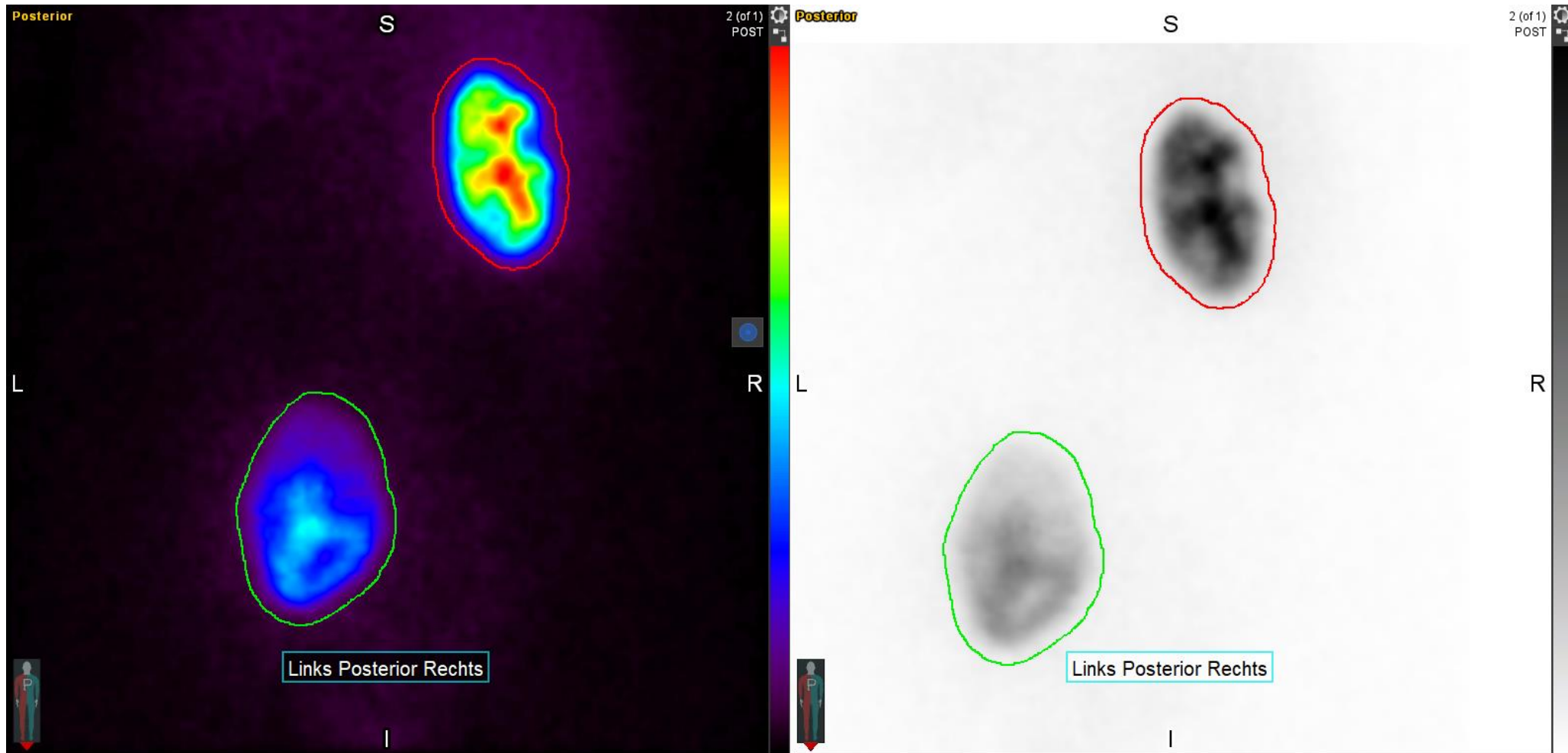
2022-06-22 14:01:30

1 / 48 (0.0°)

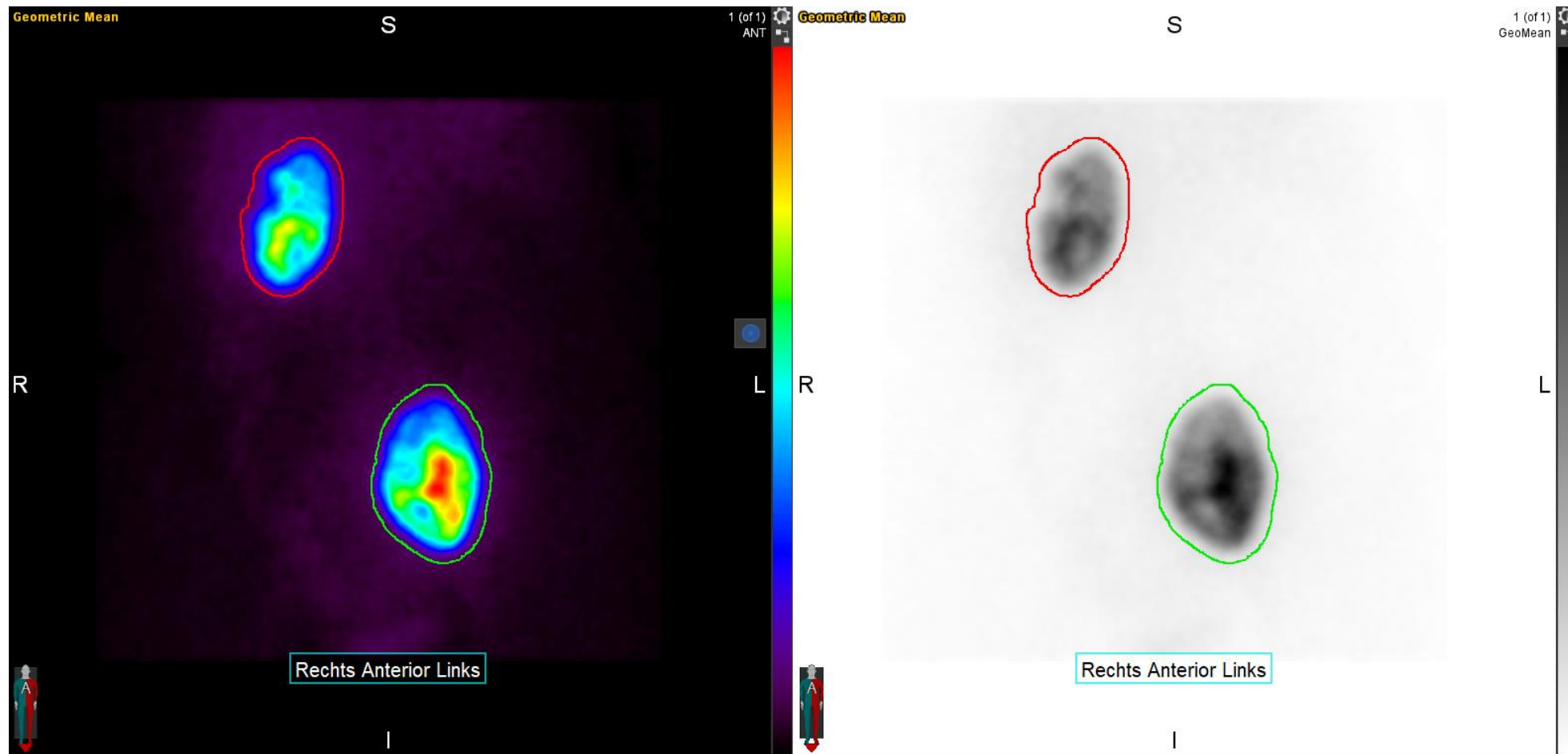




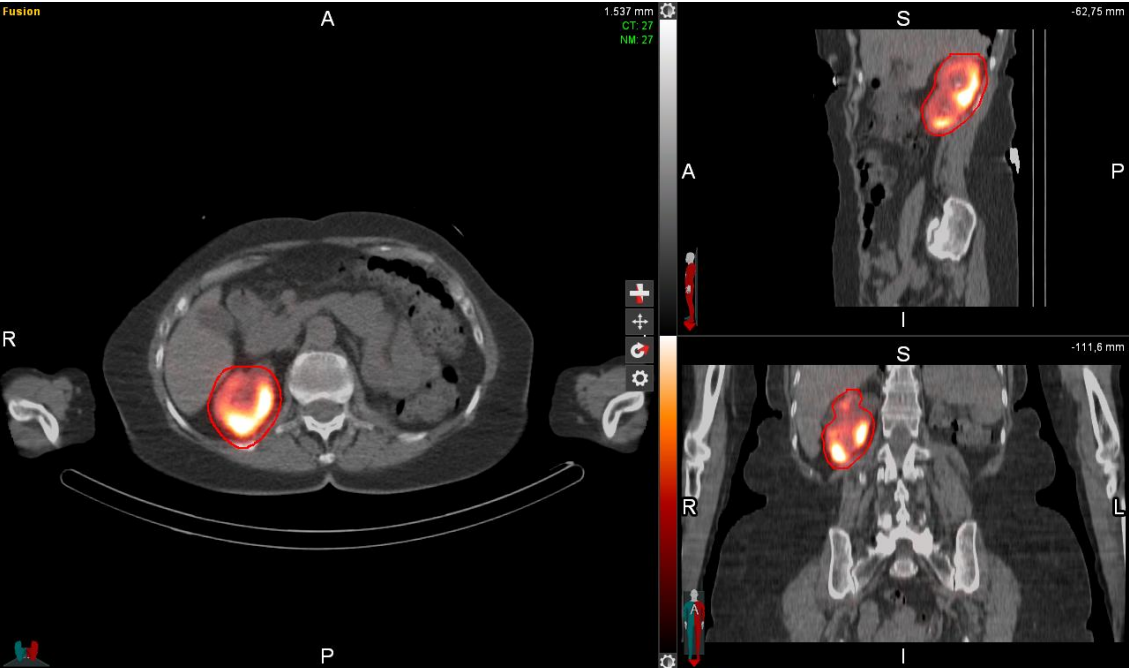




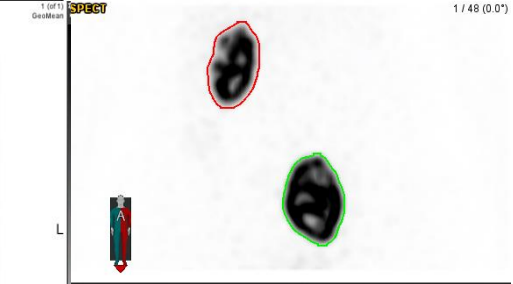
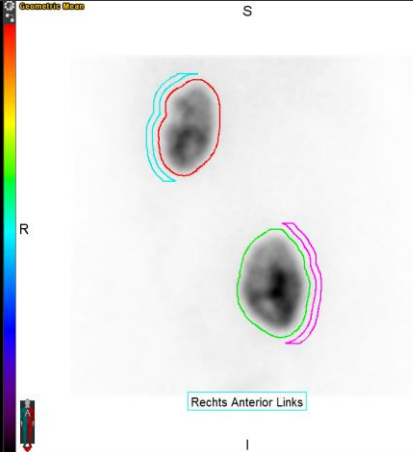
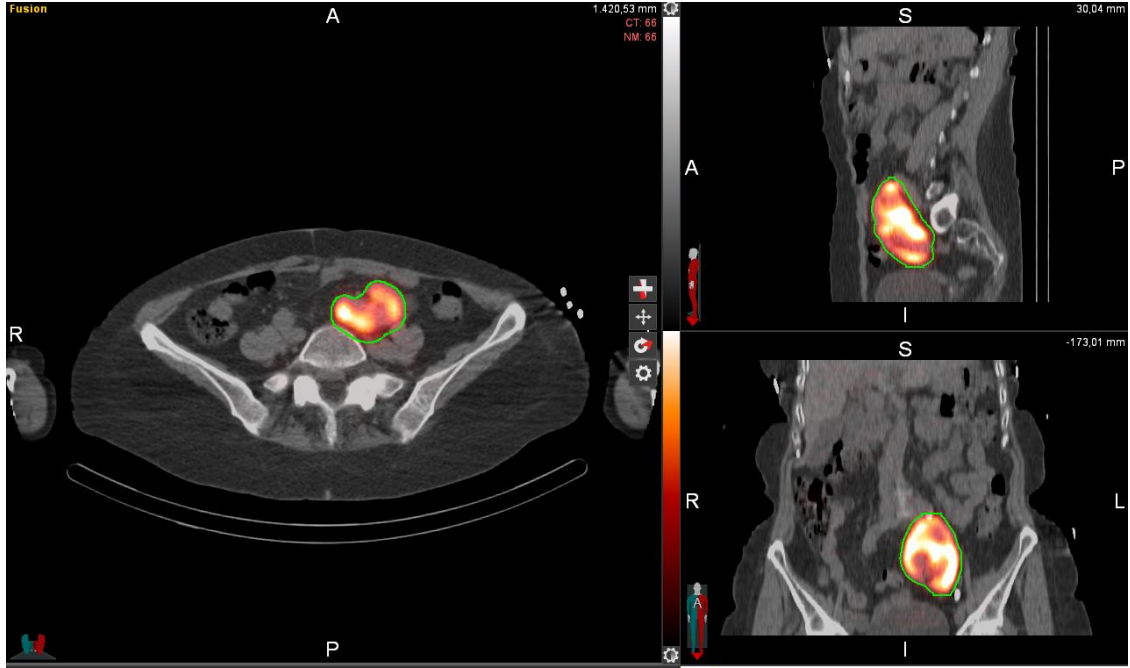
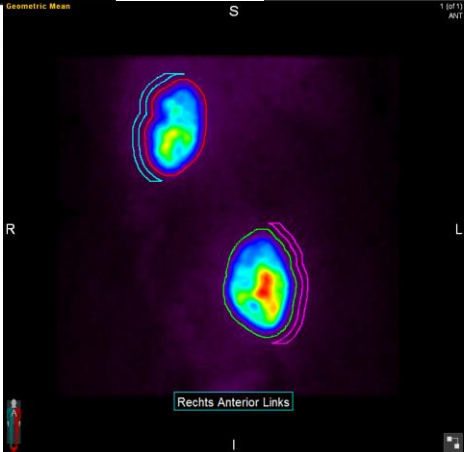
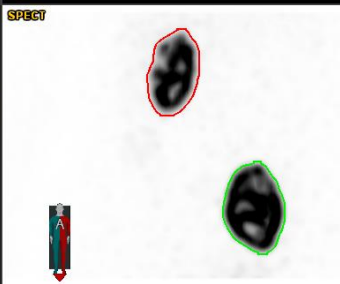
Posterior	Area [cm2]	Total [cps]	Split Function [%]
L Kidney	59	200	39
R Kidney	47	320	61



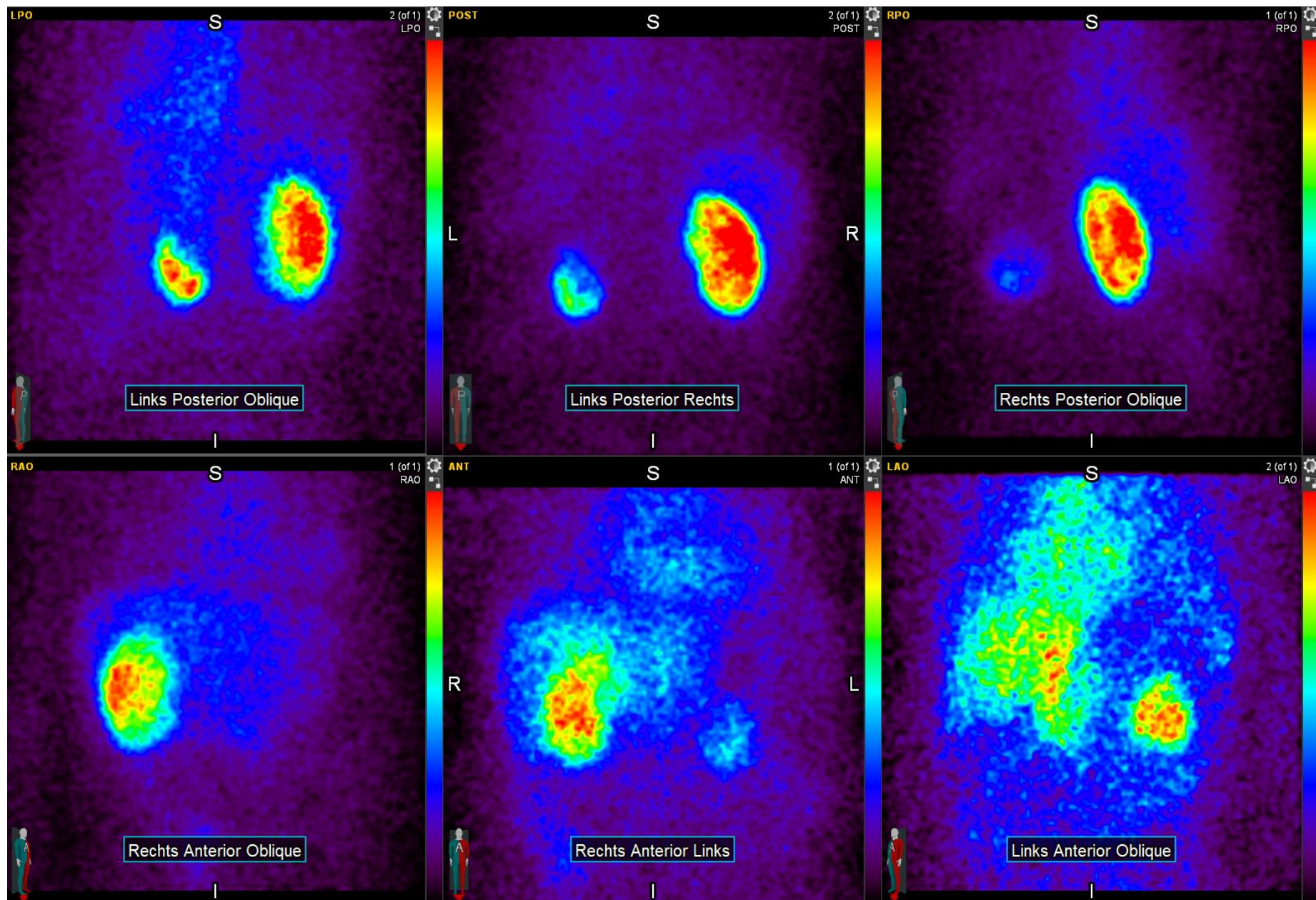
Geometric Mean	Area [cm2]	Total [cps]	Split Function [%]
L Kidney	60	260	62
R Kidney	47	150	38



SPECT	Volume [ml]	Total [kCNTS]	Split Function [%]
L Kidney	190	42000	62
R Kidney	160	26000	38



Geometric Mean	Area [cm2]	Total [cps]	Split Function [%]
L Kidney	60	260	62
R Kidney	46	150	38
Background correction			Yes



R

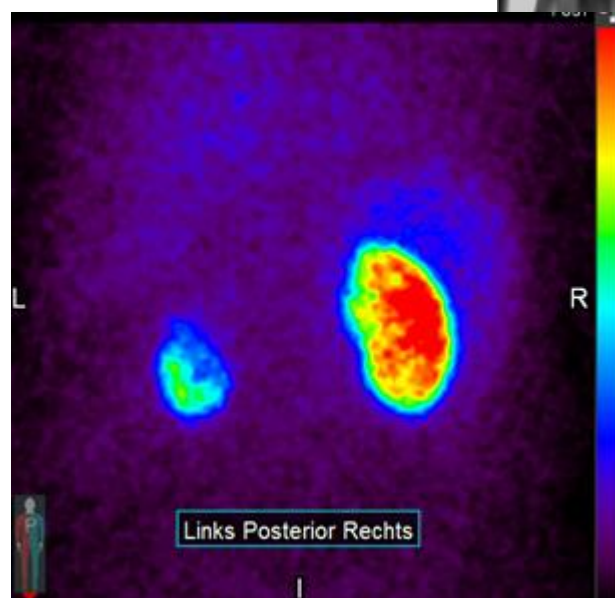
L



P



Geometric Mean	Area [cm ²]	Total [cps]	Split Function [%]
L Kidney	34	12	22
R Kidney	66	43	78
Background correction			Yes 
SPECT	Volume [ml]	Total [kCNTS]	Split Function [%]
L Kidney	150	13000	22
R Kidney	250	46000	78



Oef!

