2018 RSNA
Image Interpretation Session

Neuro

RSNA®

10 y.o. old boy with fevers and fatigue x 5 days, admitted due to altered mental status

HR 123, BP 140/90

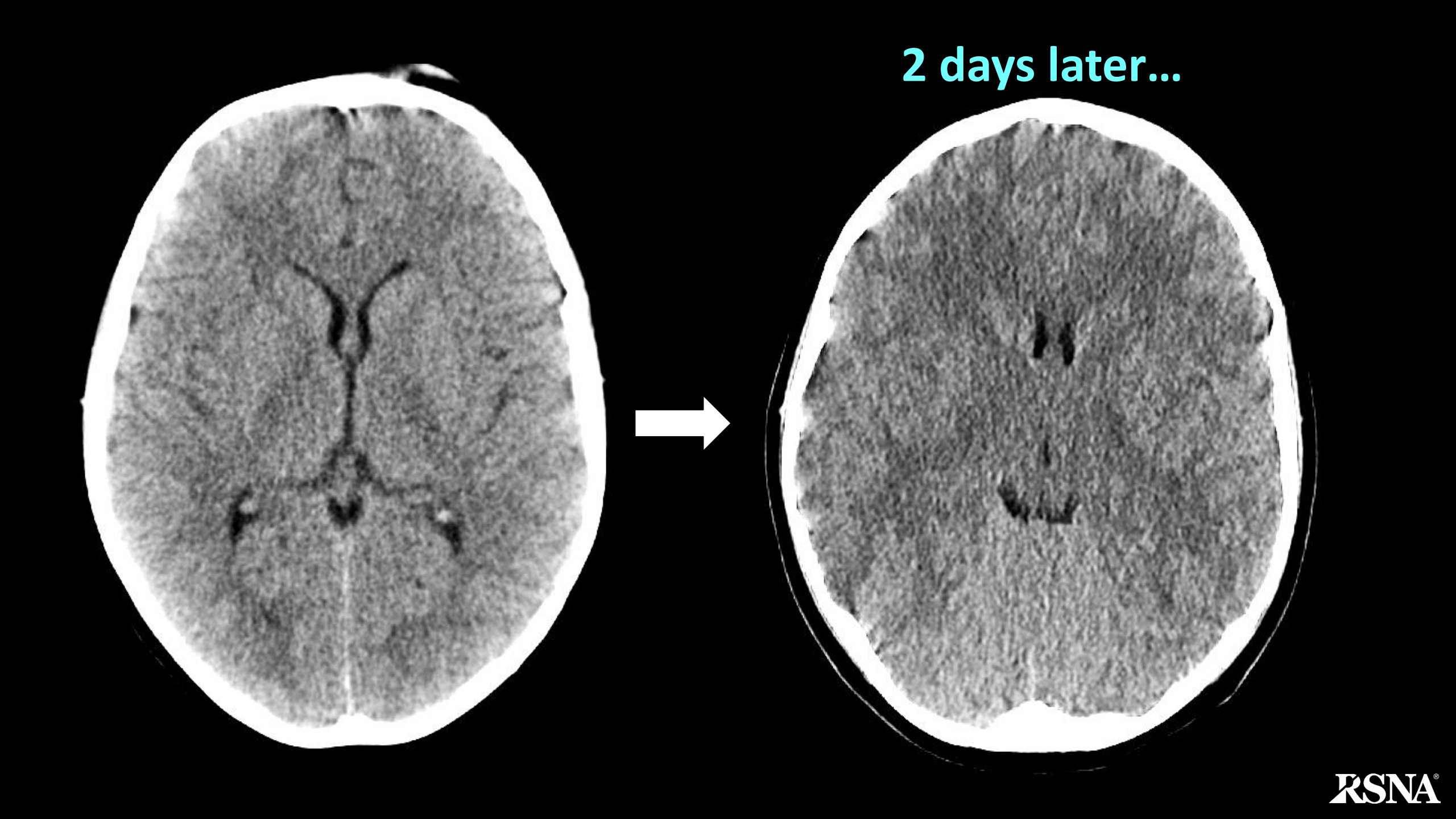
Lumbar puncture

- Opening pressure 35 cm H20
- 194 nucleated cells/mL, 99% lymphocytes
- protein 234 mg/dL
- glucose 45 mg/dL

Started acyclovir & broad spectrum antibiotics

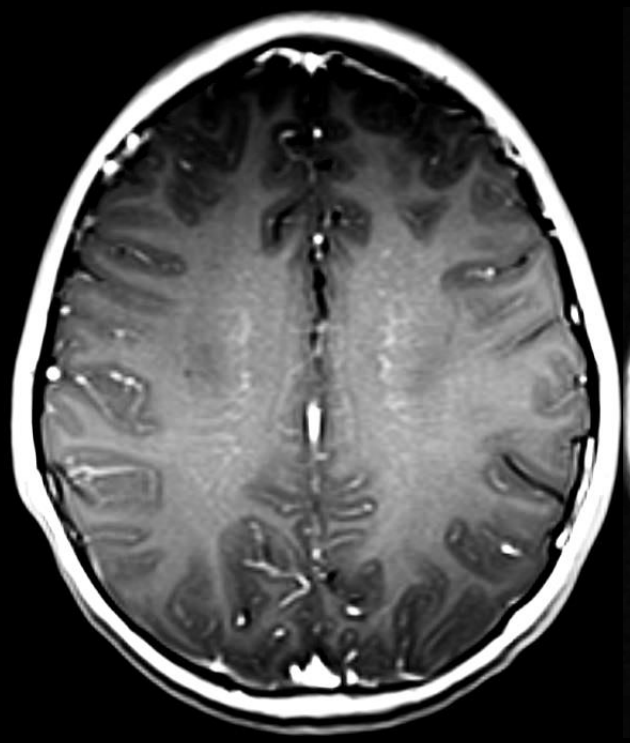
Initial Evaluation

- History – viral prodrome
- Exam - Fever, HTN, tachycardia
- LP – lymphocytic pleocytosis, high opening pressure
- RX – acyclovir, antibiotics

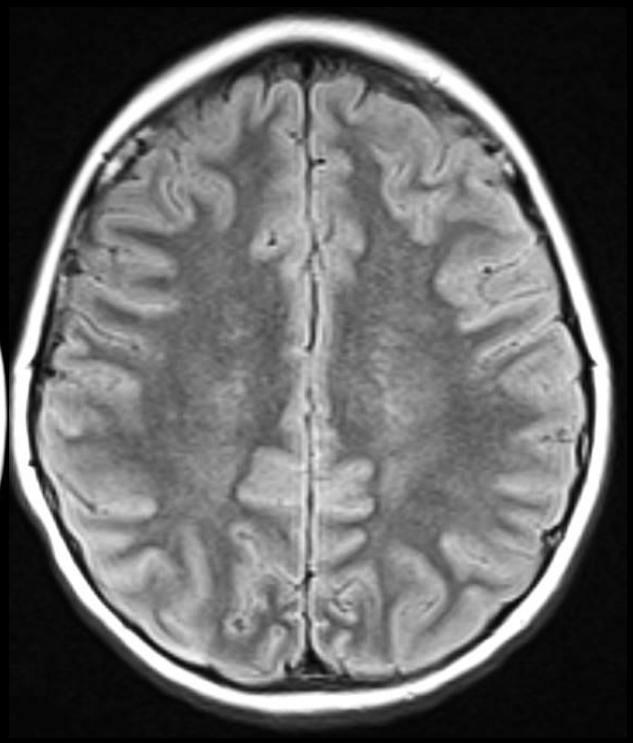

2 days later…

1 day later… *CSF cultures and PCR come back negative; continued tachycardia and hypertension*

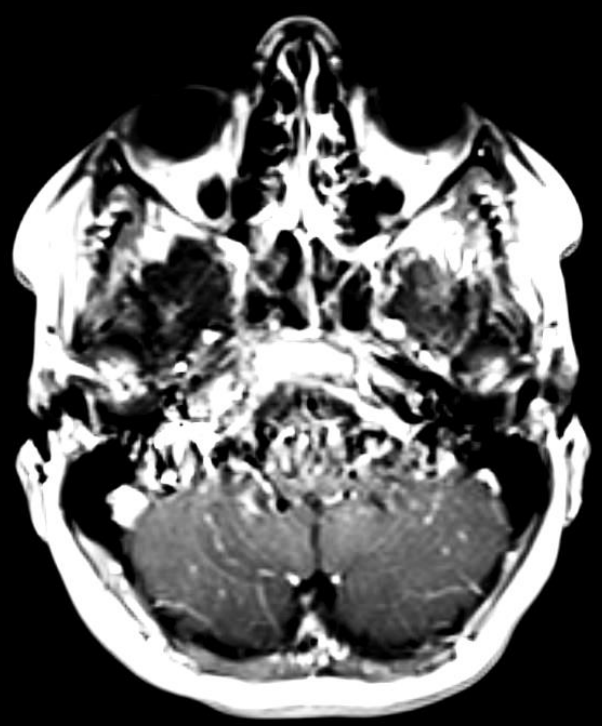
- Subtle central perivascular enhancement
- Leptomeningitis



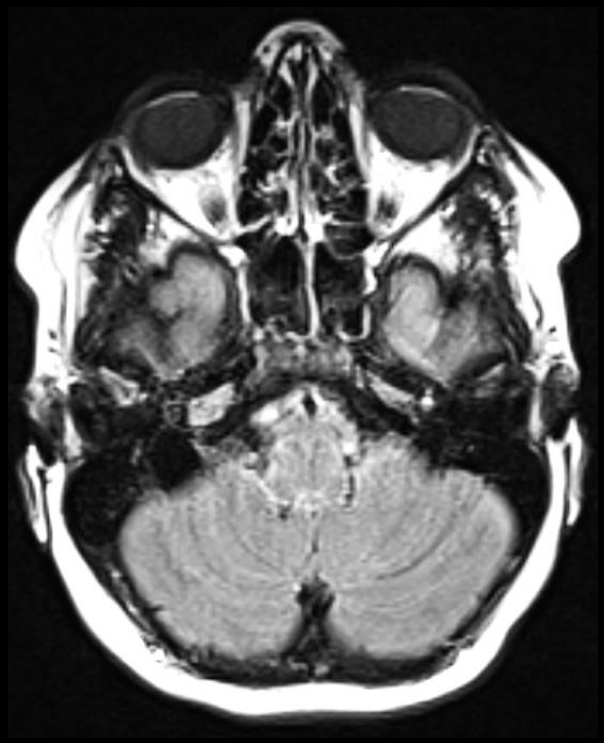
T1+



FLAIR



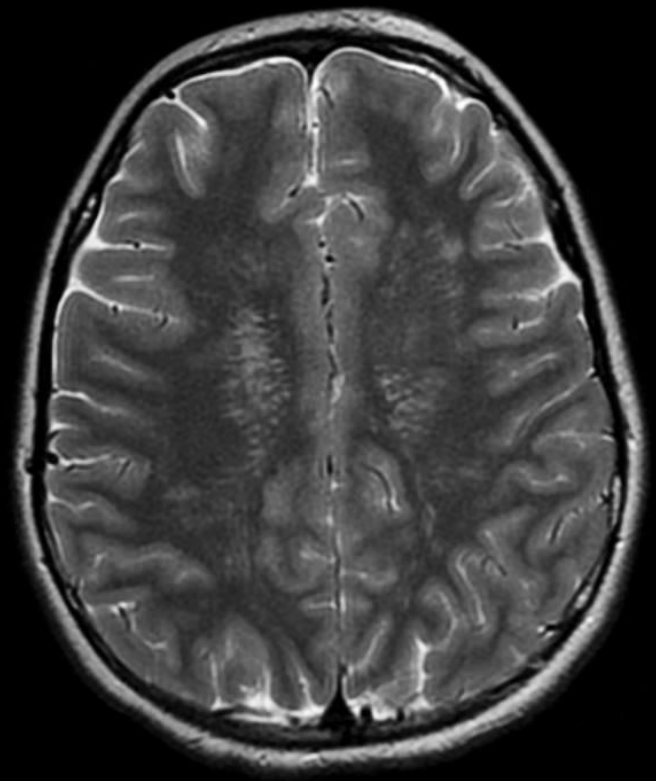
T1+



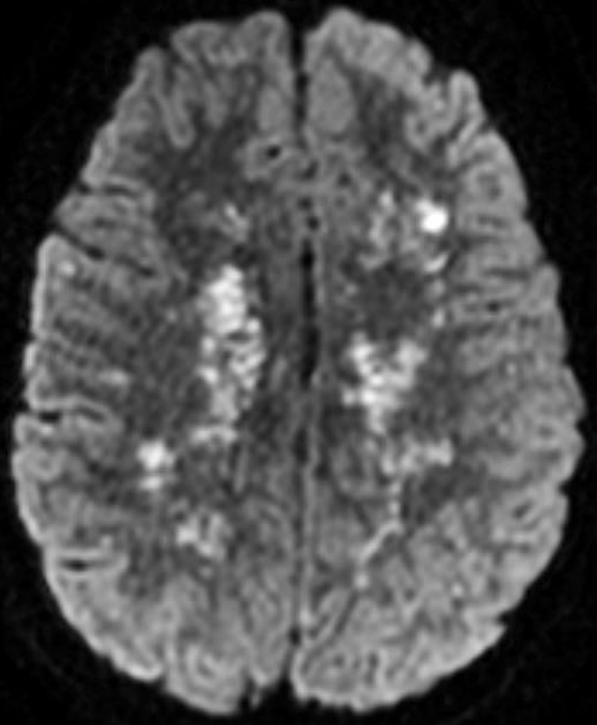
FLAIR

3 days later… *coma, flaccid paralysis*

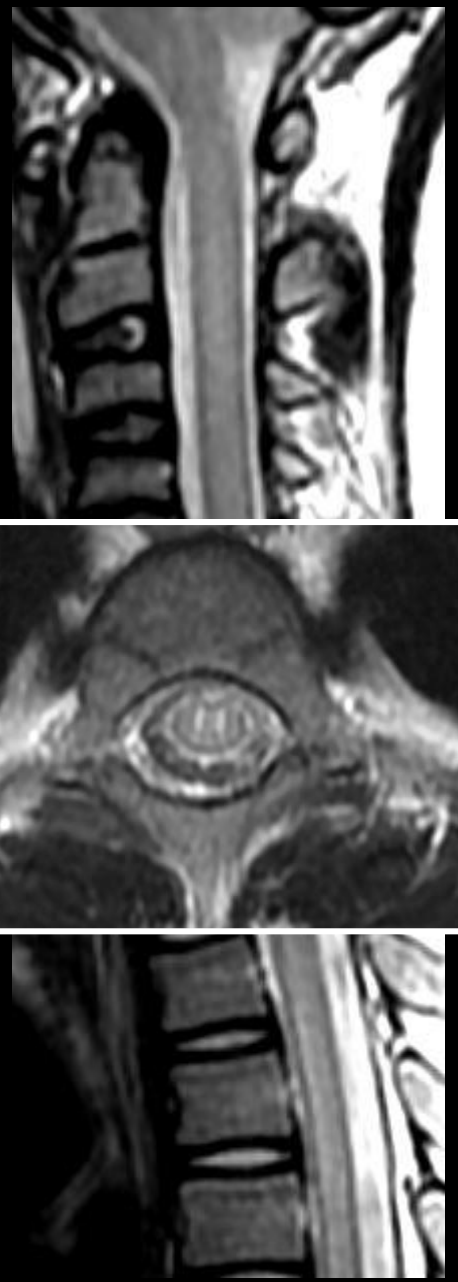
- Periventricular T2 worse, reduced DWI
- Longitudinally extensive myelitis
- Subtle spinal leptomeningeal enhancement



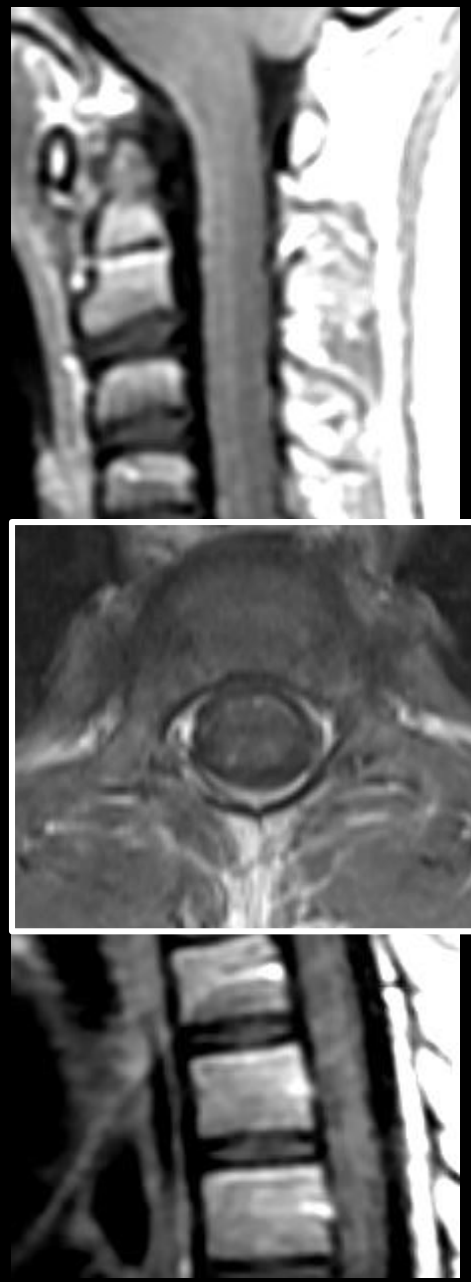
T2



DWI



T2

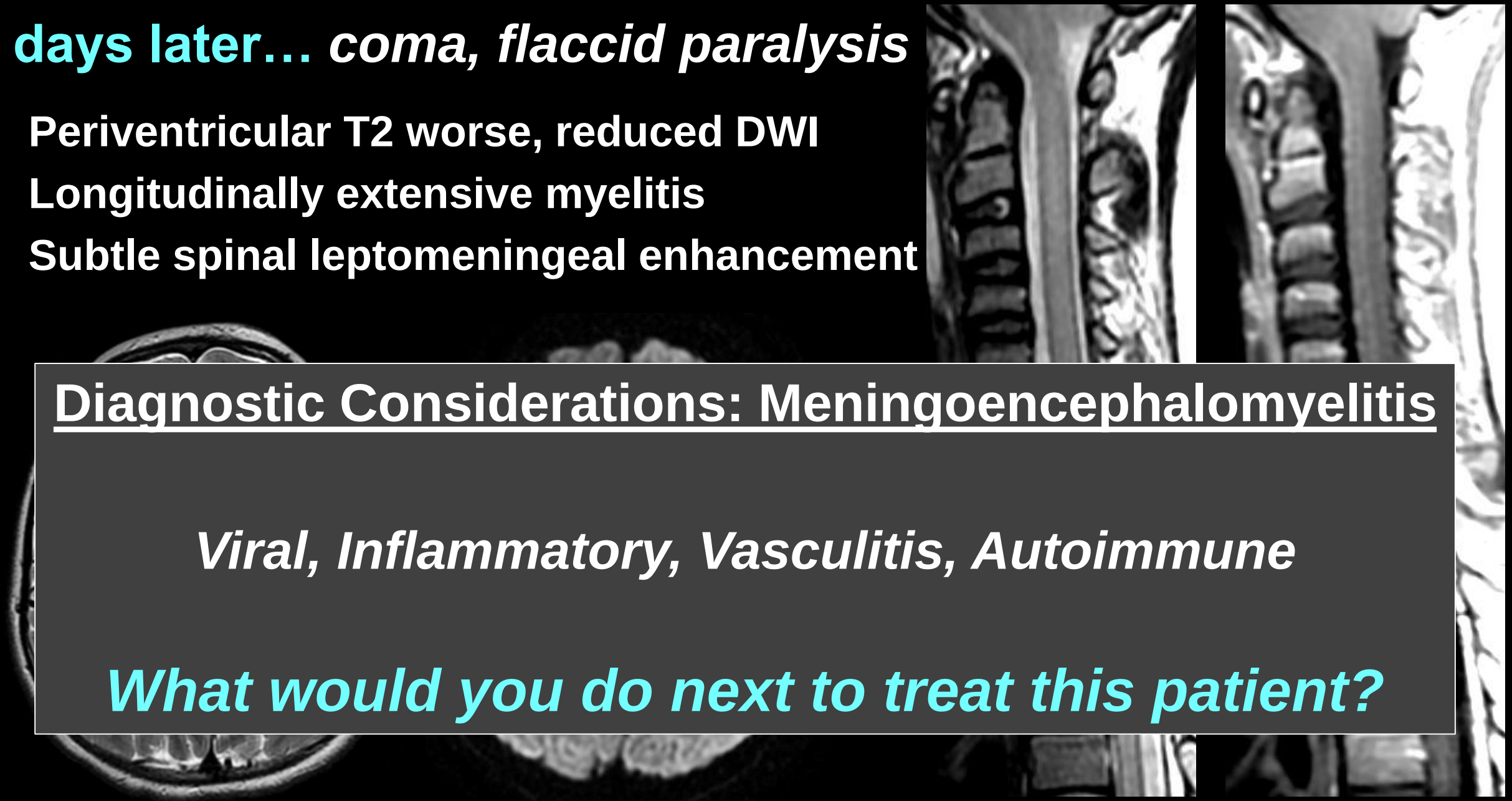


T1+

RSNA

3 days later… *coma, flaccid paralysis*

- Periventricular T2 worse, reduced DWI
- Longitudinally extensive myelitis
- Subtle spinal leptomeningeal enhancement



Diagnostic Considerations: Meningoencephalomyelitis

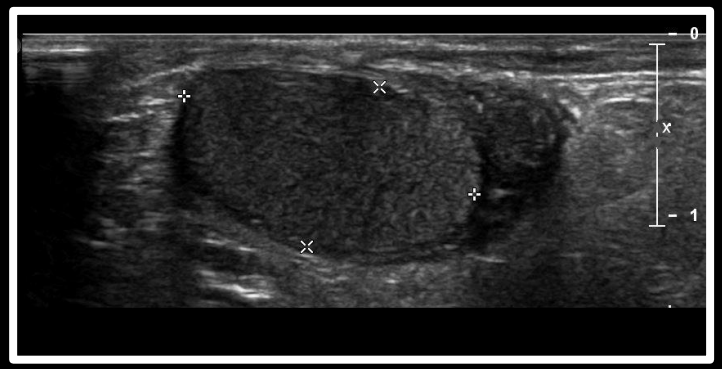
Viral, Inflammatory, Vasculitis, Autoimmune

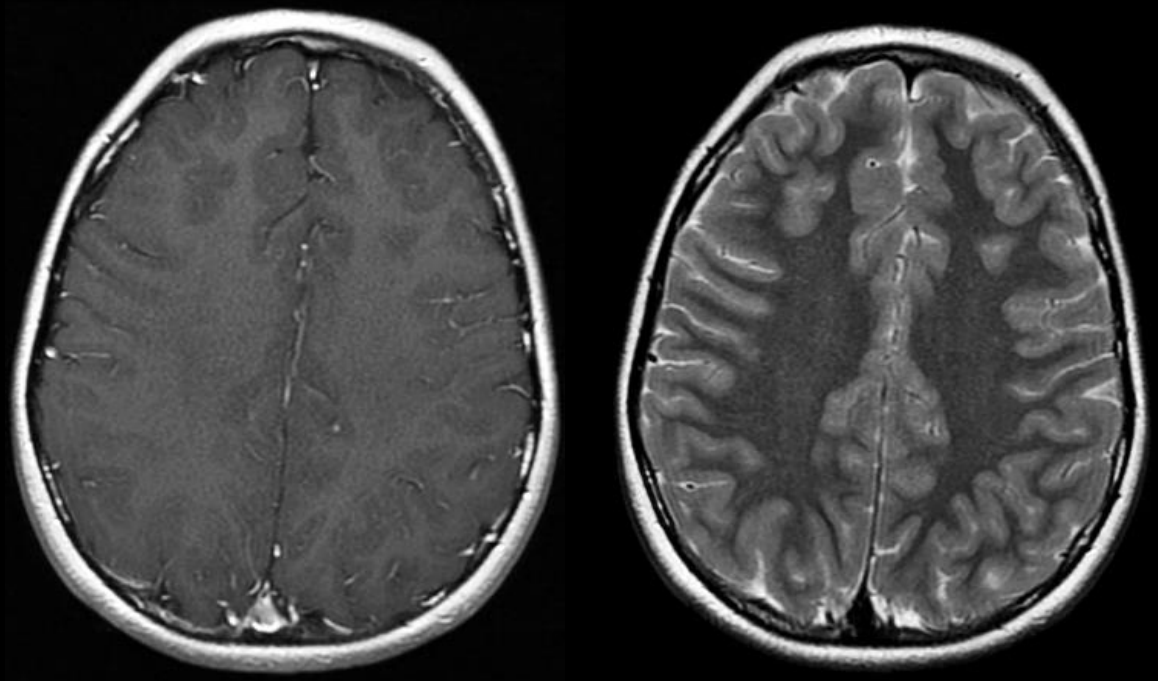
What would you do next to treat this patient?

T2 DWI T2 T1+

Steroids, IVIG, Plasmapheresis… *dramatic improvement !*

- Walking with assistance 2 weeks later
- Maintained on IV steroids – deficits resolve (mild difficulty concentrating)
- Brain MRI normal on 6 month follow-up
- Normal CAP CT, scrotal US





T1+ T2

Differential Diagnosis

Viral
Inflammatory
Vasculitis
Autoimmune

RSNA

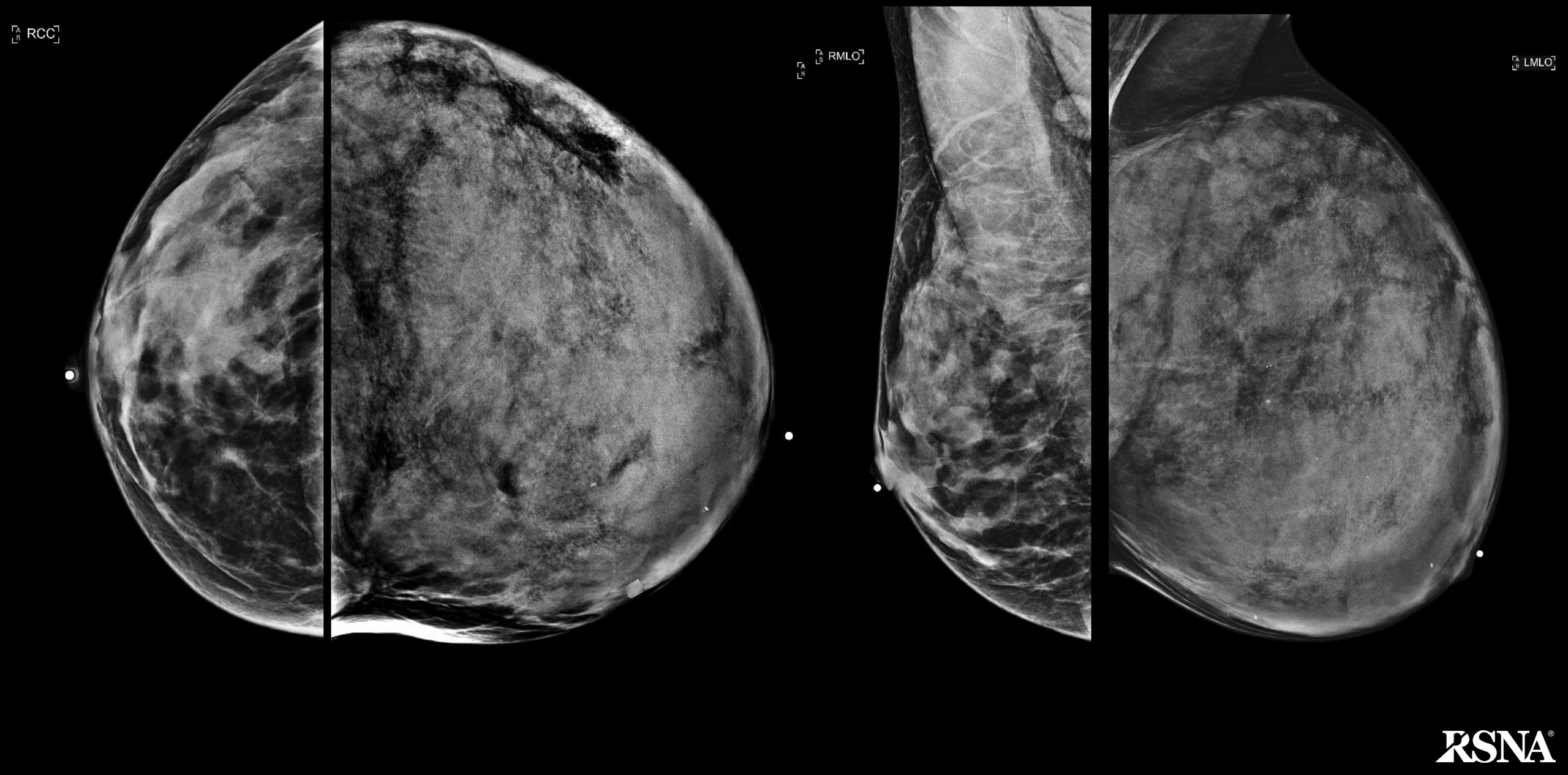
2018 RSNA
Image Interpretation Session

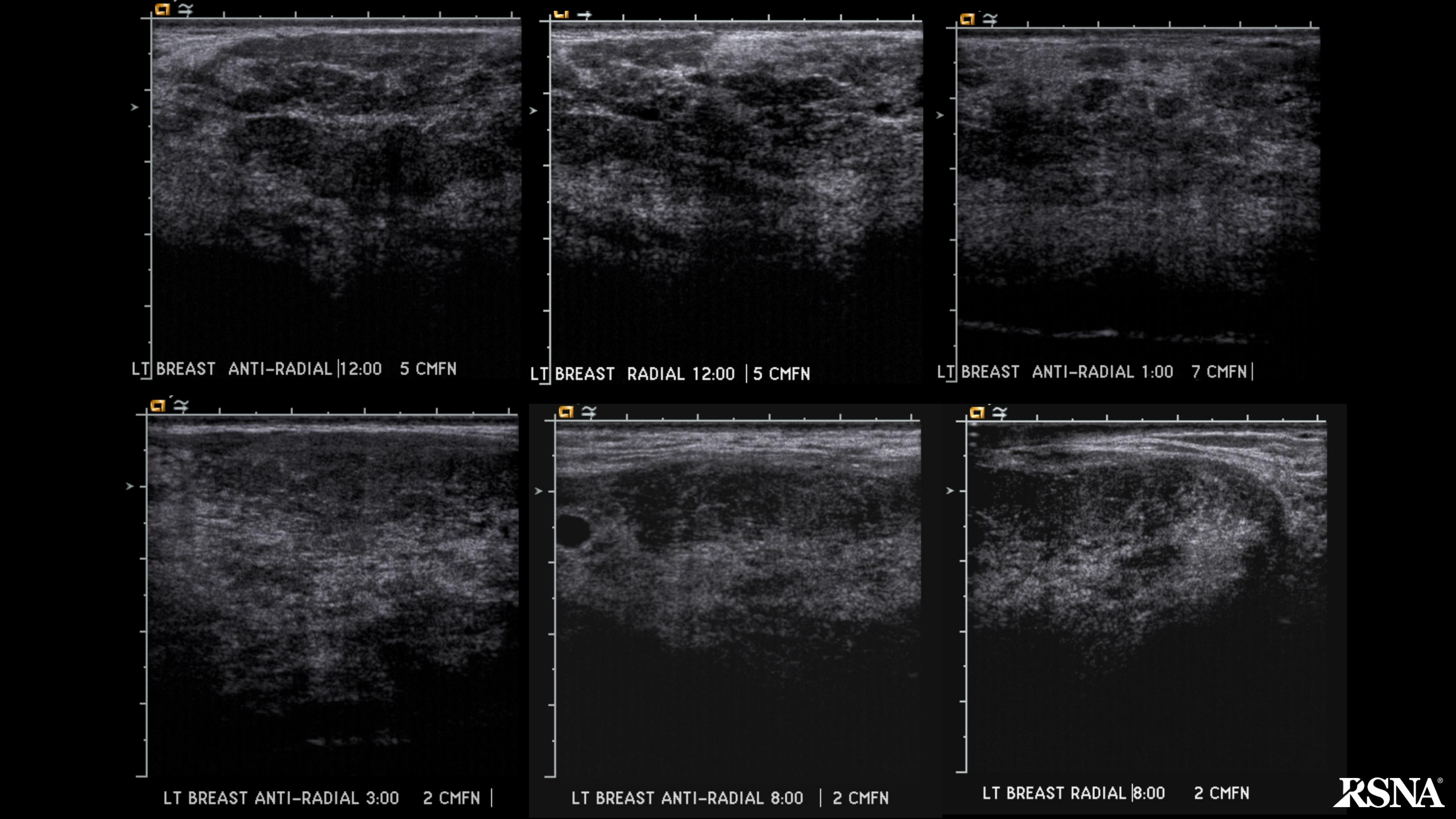
Breast

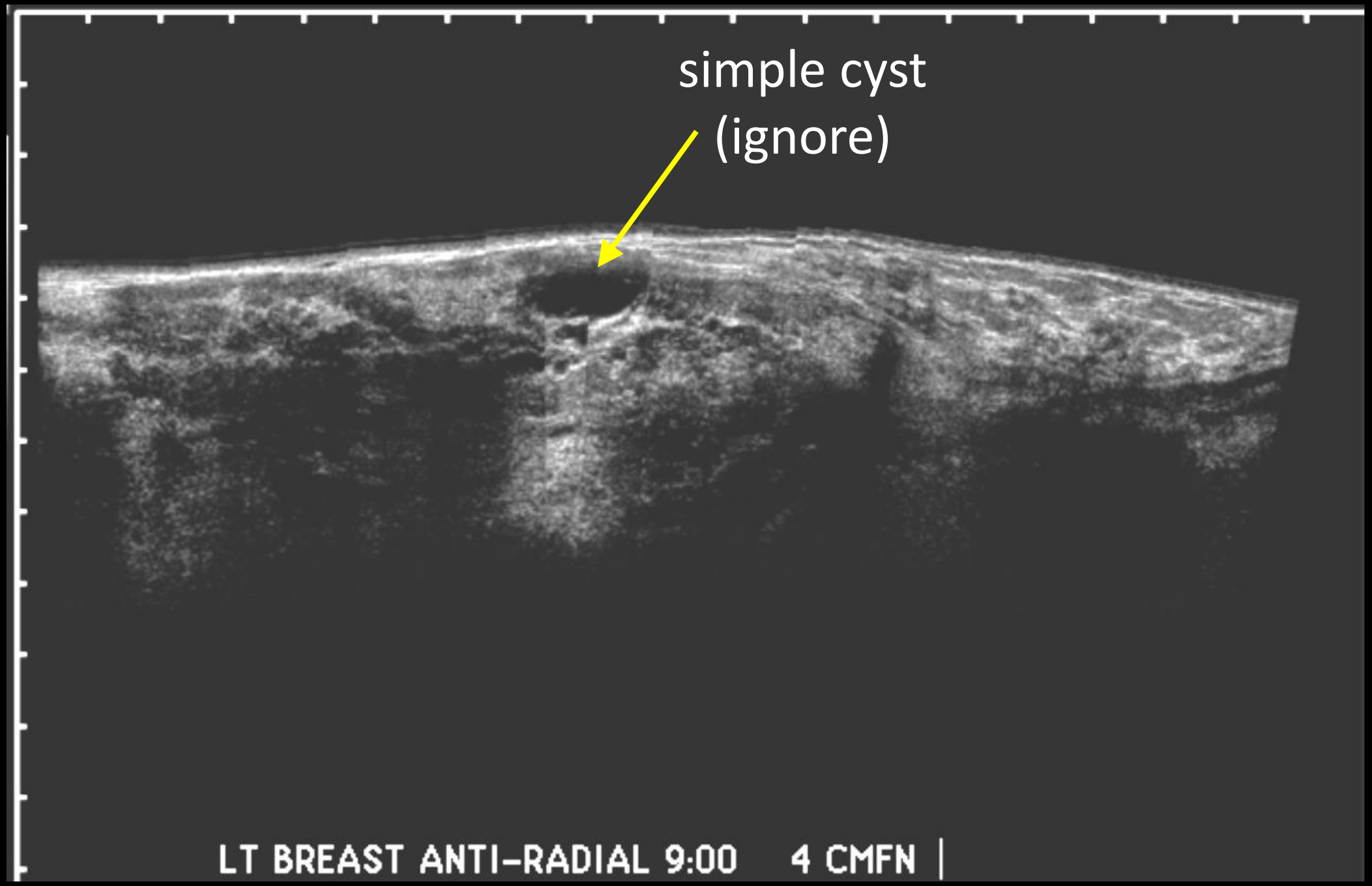
RSNA®

History

- **37 yo woman with no contributing history**
- **Presents with painless enlarging left breast over last 12 months. Left now 2 bra sizes asymmetric c/w right**
- **Physical exam:**
  - **right breast normal exam**
  - **left breast diffusely firm, no skin changes, no axillary or supra-clavicular adenopathy; prominent veins visible throughout the left breast**


RCC
RMLO
LMLO

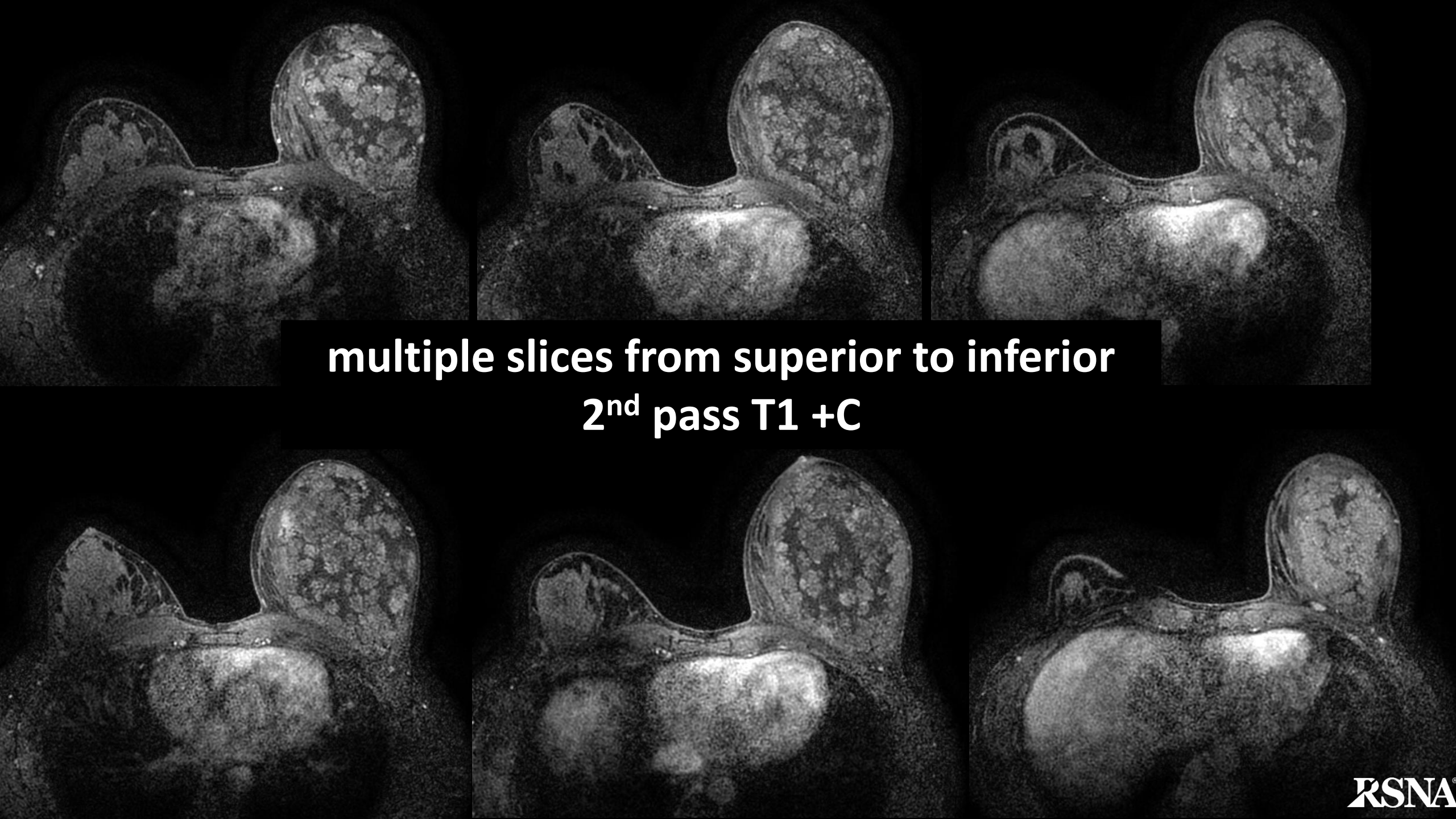

LT BREAST ANTI-RADIAL 12:00 5 CMFN
LT BREAST RADIAL 12:00 5 CMFN
LT BREAST ANTI-RADIAL 1:00 7 CMFN
LT BREAST ANTI-RADIAL 3:00 2 CMFN
LT BREAST ANTI-RADIAL 8:00 2 CMFN
LT BREAST RADIAL 8:00 2 CMFN

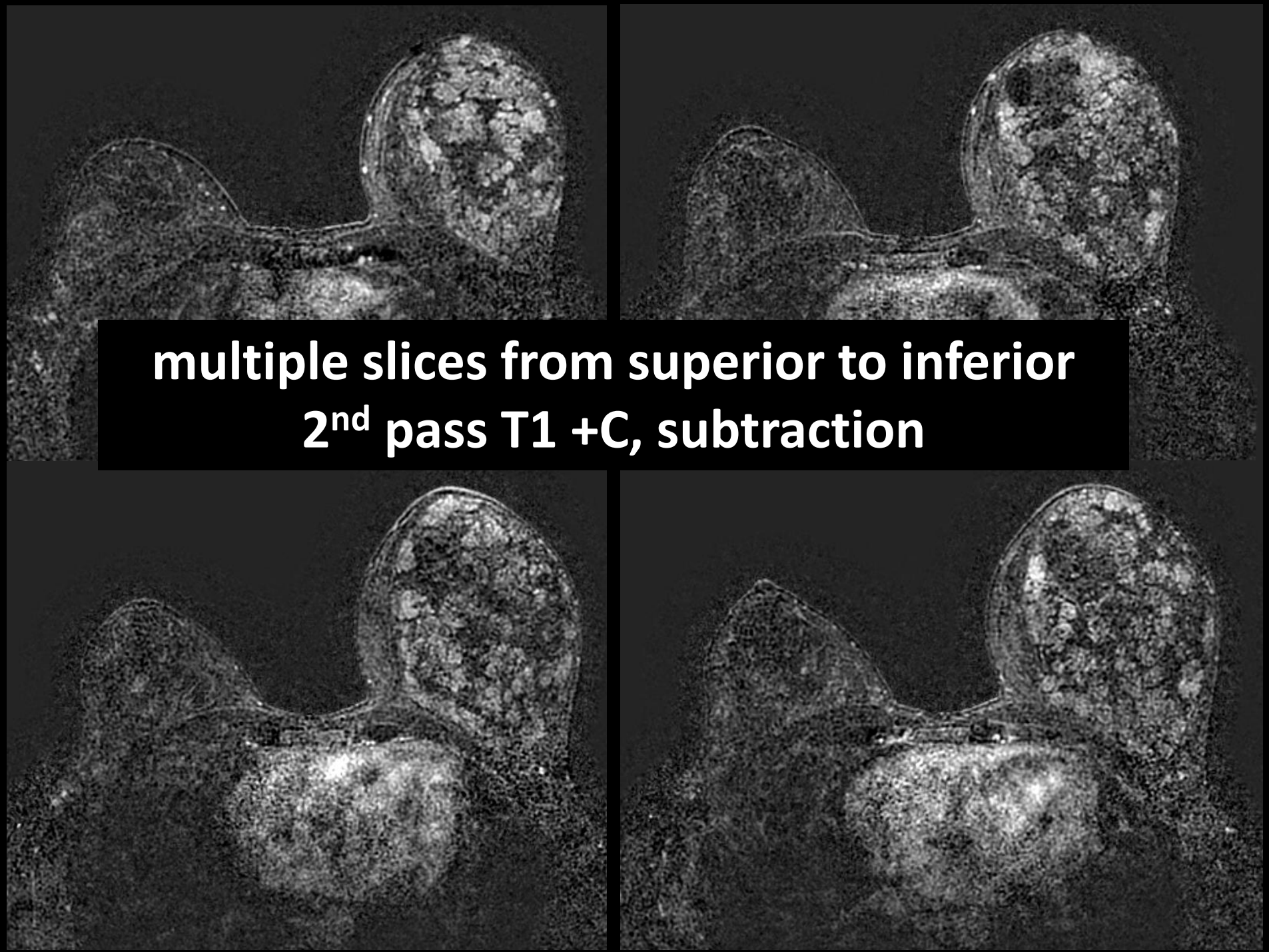

simple cyst
(ignore)
LT BREAST ANTI-RADIAL 9:00 4 CMFN

Large painless mass in a young woman without adenopathy/skin changes growing over a year

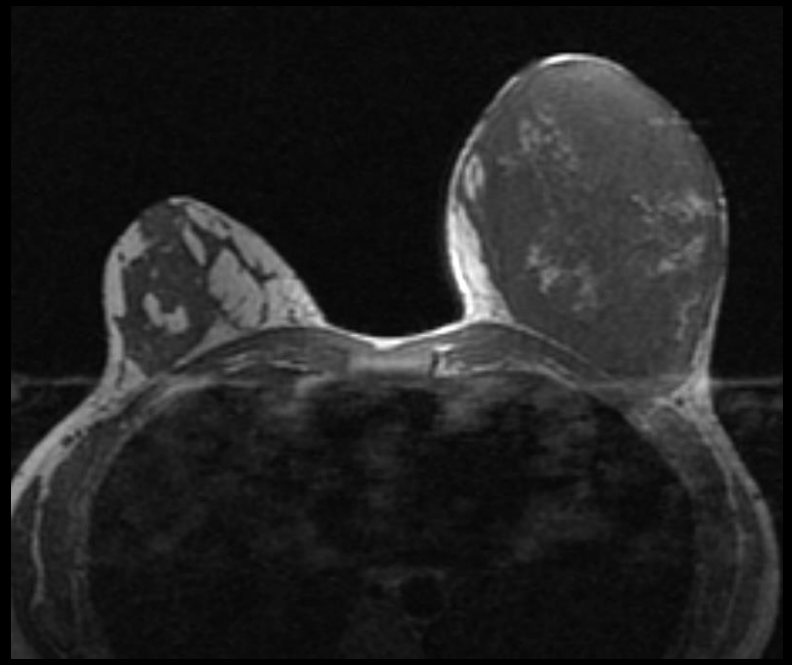
- Lipofibroadenoma (hamartoma)
- Giant Fibroadenoma / Phyllodes Tumor
- Cancer / Angiosarcoma
- Lymphangiomatosis
- Giant Pseudoangiomatous Stromal Hyperplasia (PASH)

Biopsy performed at this point

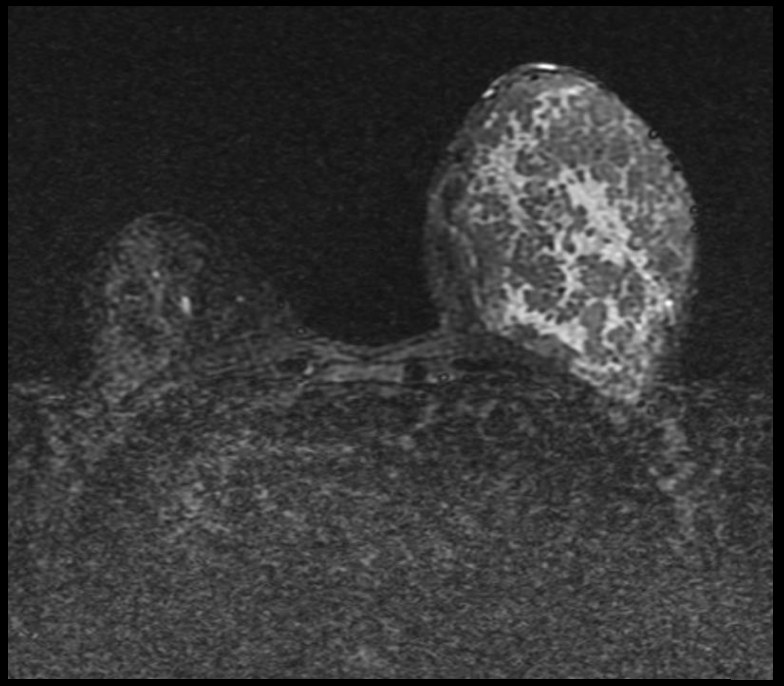

multiple slices from superior to inferior
2nd pass T1 +C


multiple slices from superior to inferior
2nd pass T1 +C, subtraction

T1 fat-sat, pre-contrast



T1 non fat-sat



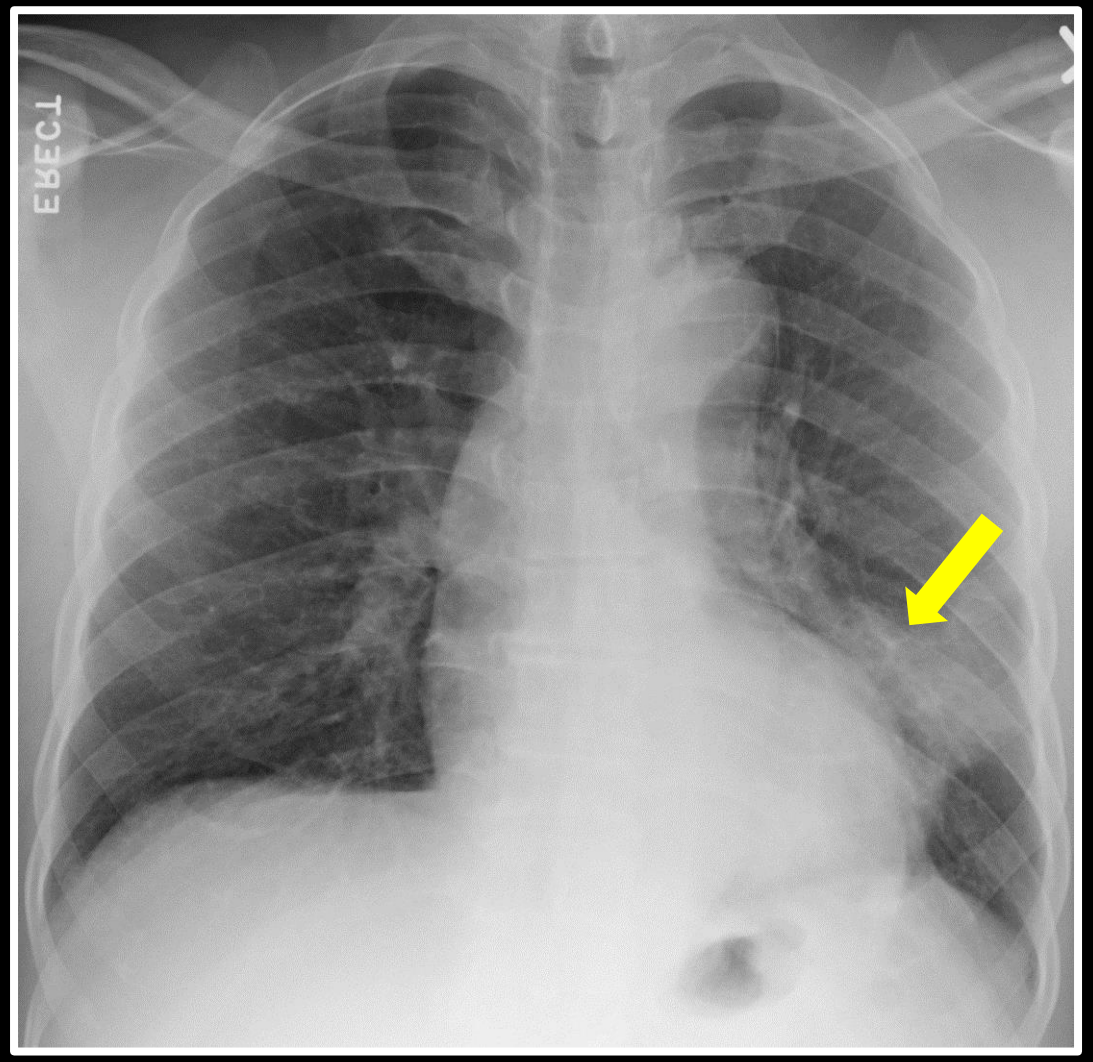
T2WI

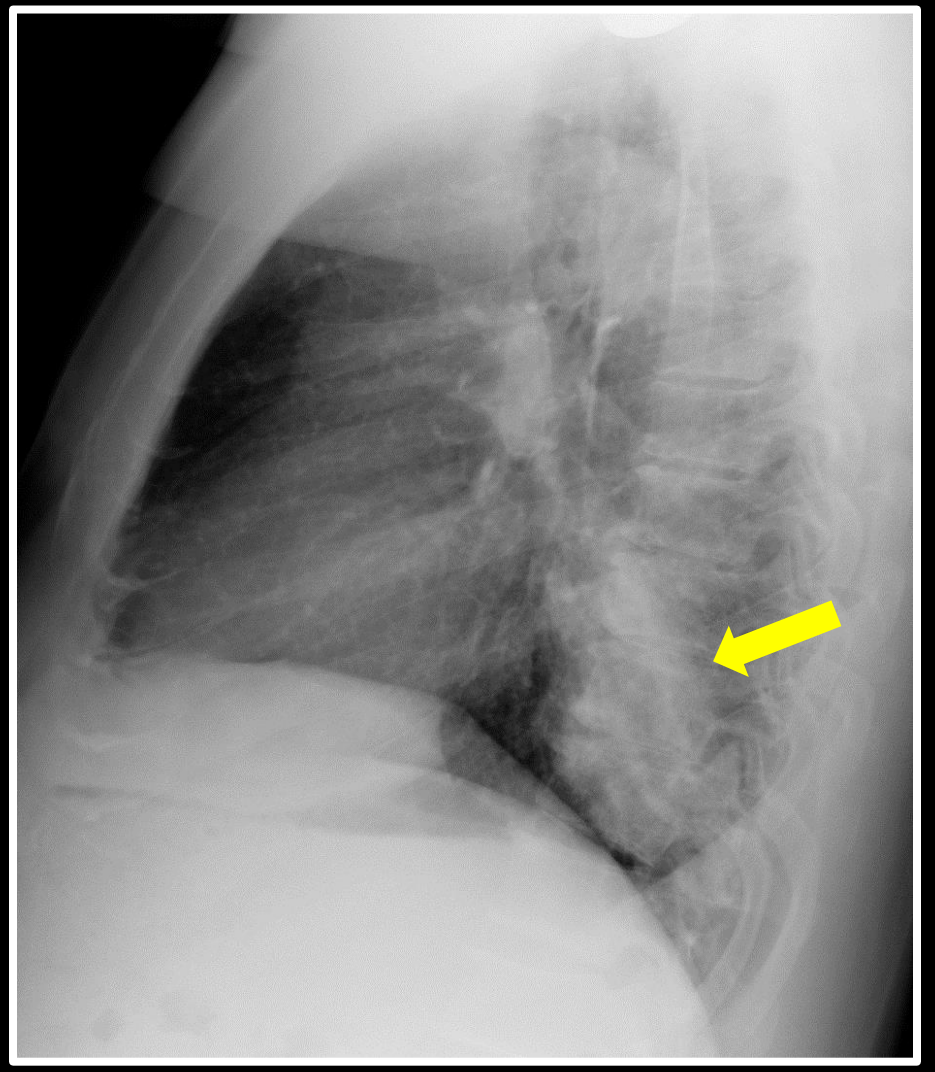
2018 RSNA
Image Interpretation Session

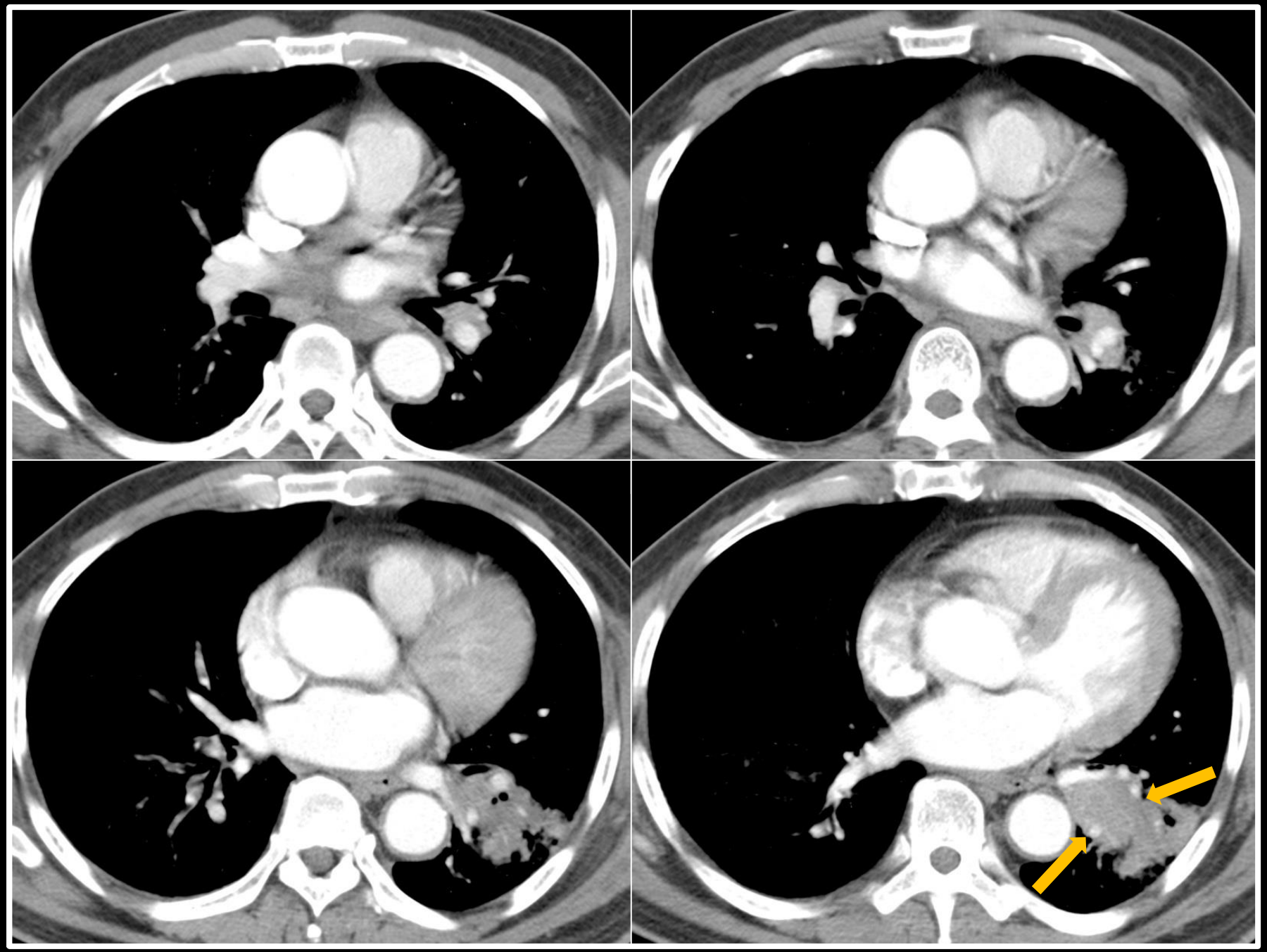
Thoracic

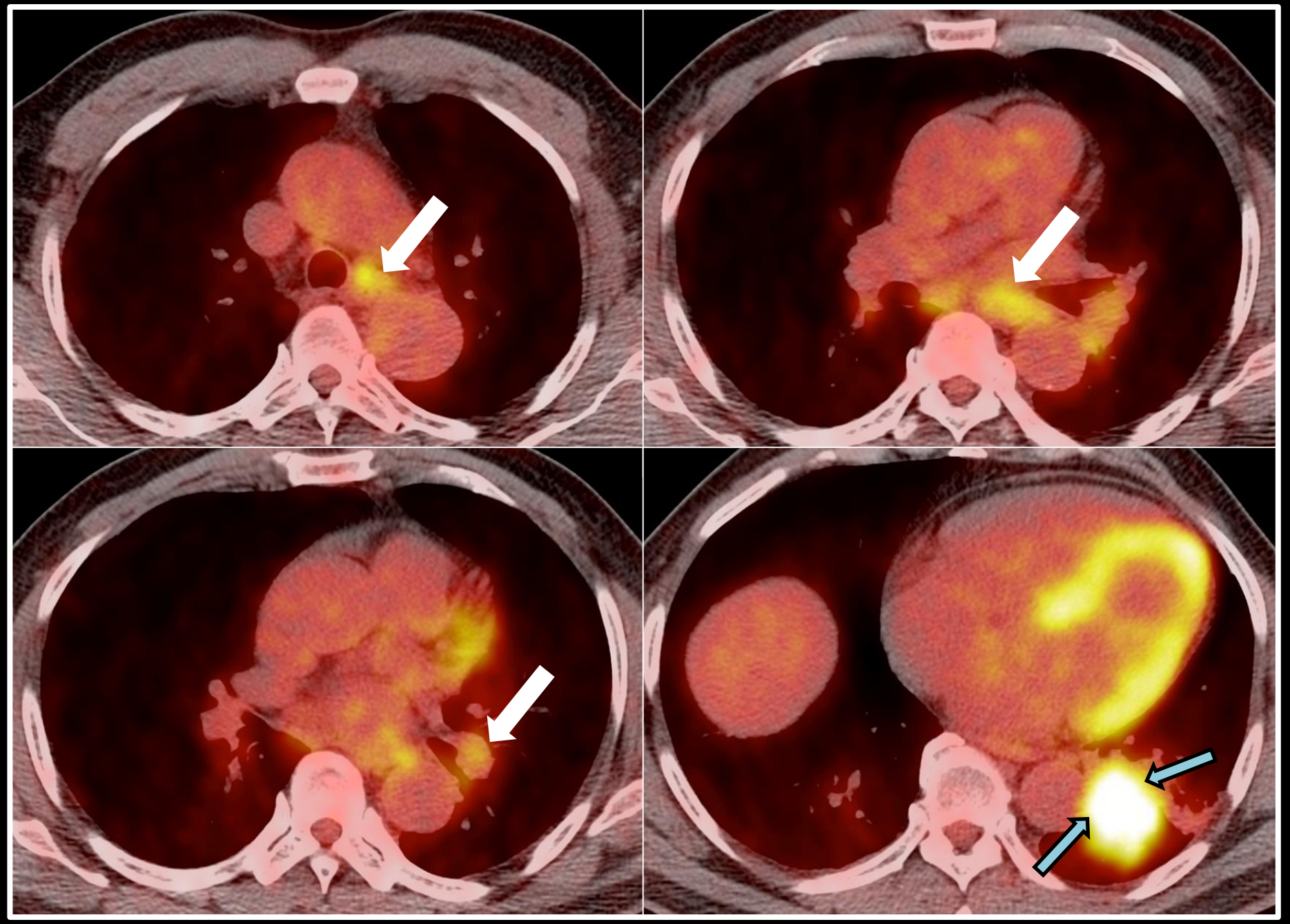
RSNA®

Middle age man;
former smoker, hemoptysis









Imaging Findings

- **CXR:** Ill-defined mass in the LLL extending from the left hilum.
- **Contrast enhanced CT**: Homogeneous non-cavitary soft-tissue mass with left hilar adenopathy, displacement of broncho-vascular structures and areas of peripheral collapse
- **PET-CT: Intense** homogenous increased glucose uptake of the mass and increased abnormal glucose uptake in left lower paratracheal, subcarinal nodal station and left hilum **(> than reactive uptake)**

Differential Diagnosis

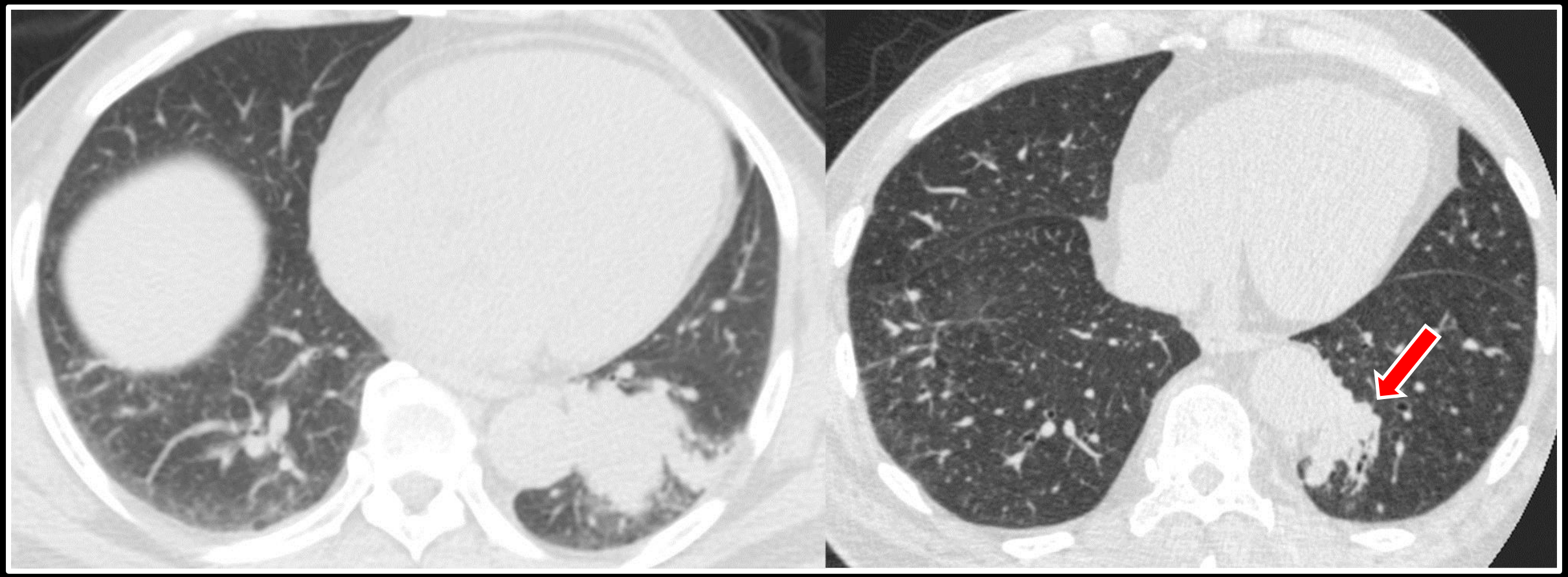
Solitary lung mass with lymphadenopathies: many possibilities

1. **Neoplastic:** Lung cancer (invasive ADK, undifferentiated neuroendocrine tumor (carcinoid), Maltoma,…
2. **Inflammatory / Granulomatous:** Sarcoidosis, IgG4 disease, GPA, Bronchocentric granulomatosis…
3. **Infectious:** Mycobacteria, Fungi

A diagnostic procedure is performed and treatment is started

Increasing dyspnea after 4 months of treatment

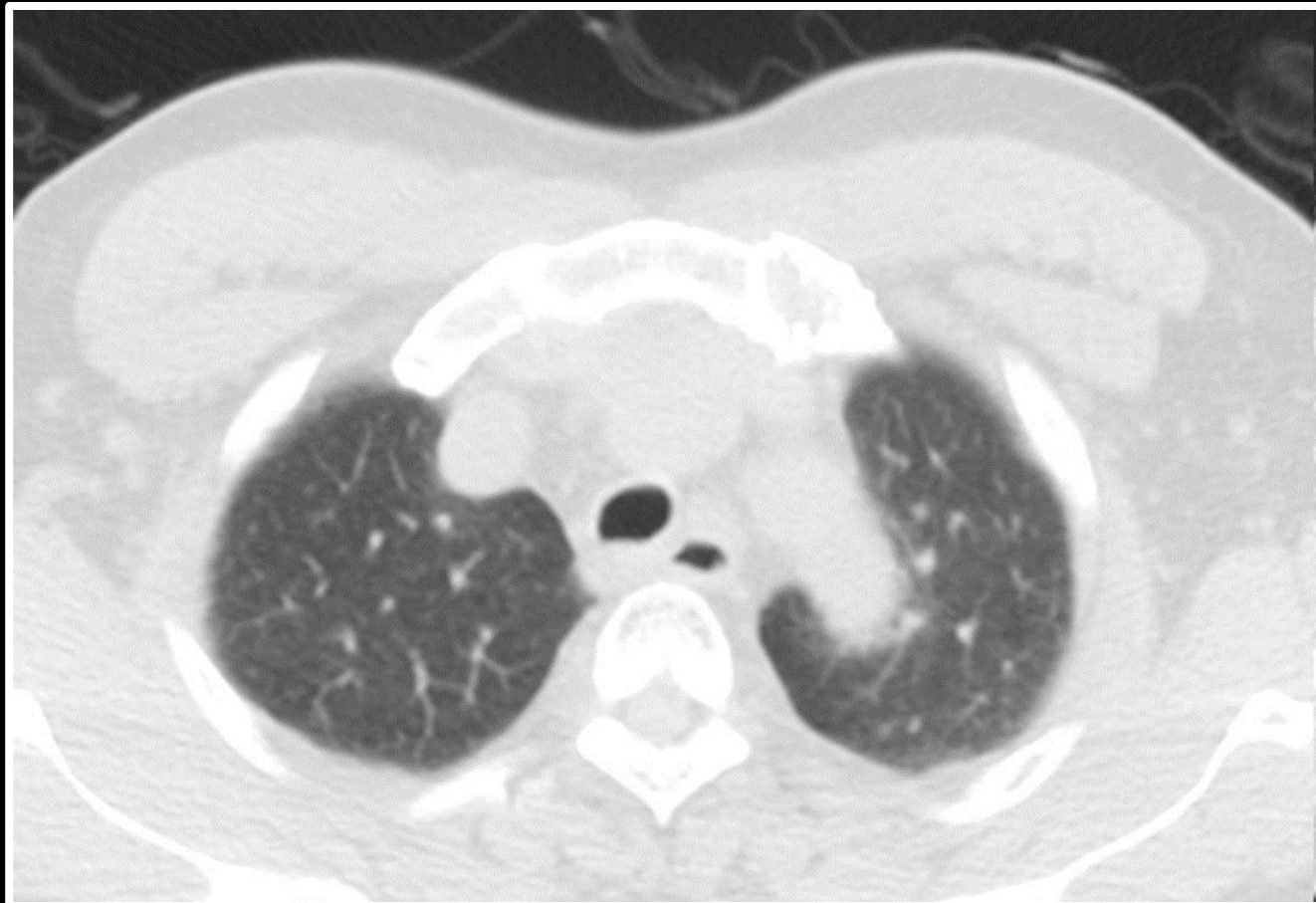
Increasing dyspnea after 4 months of treatment



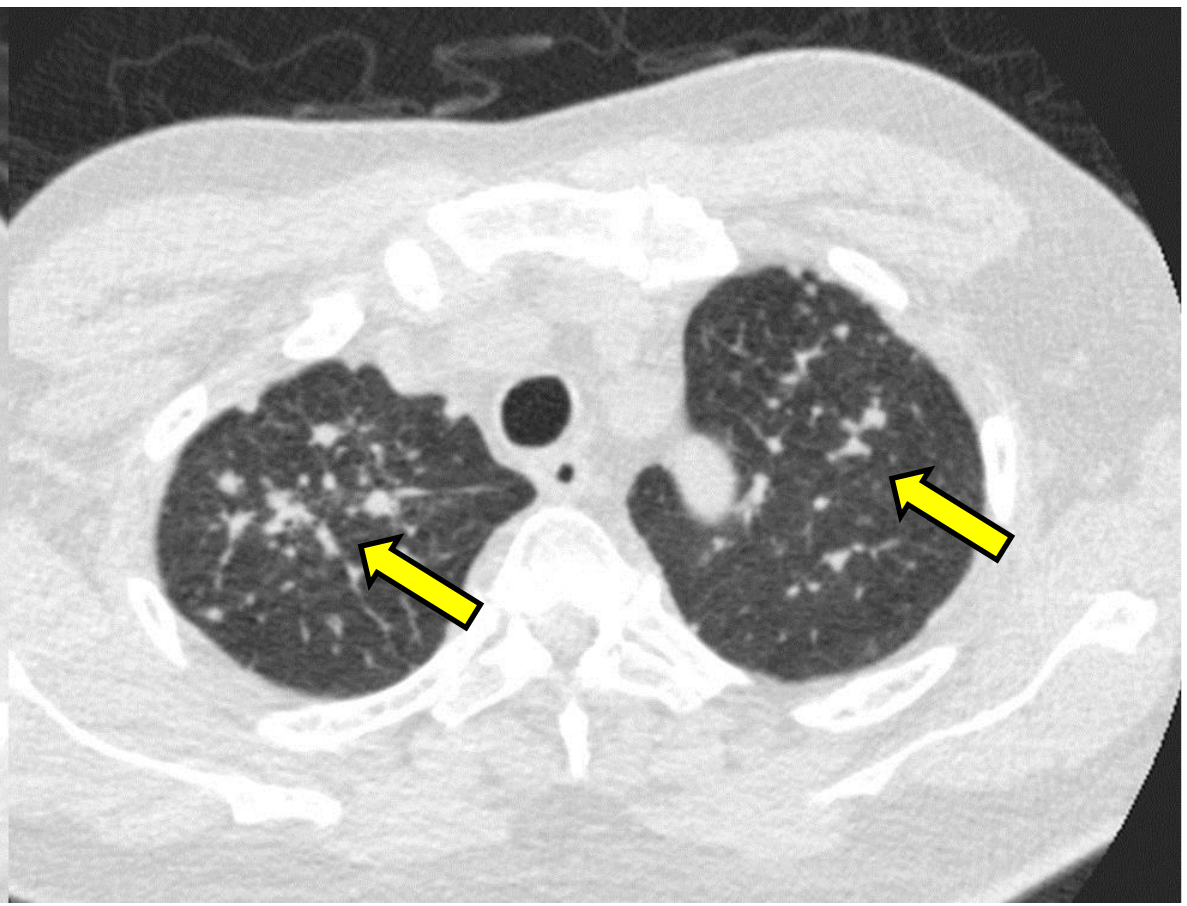
Baseline

4 months later

Increasing dyspnea after 4 months of treatment



Baseline



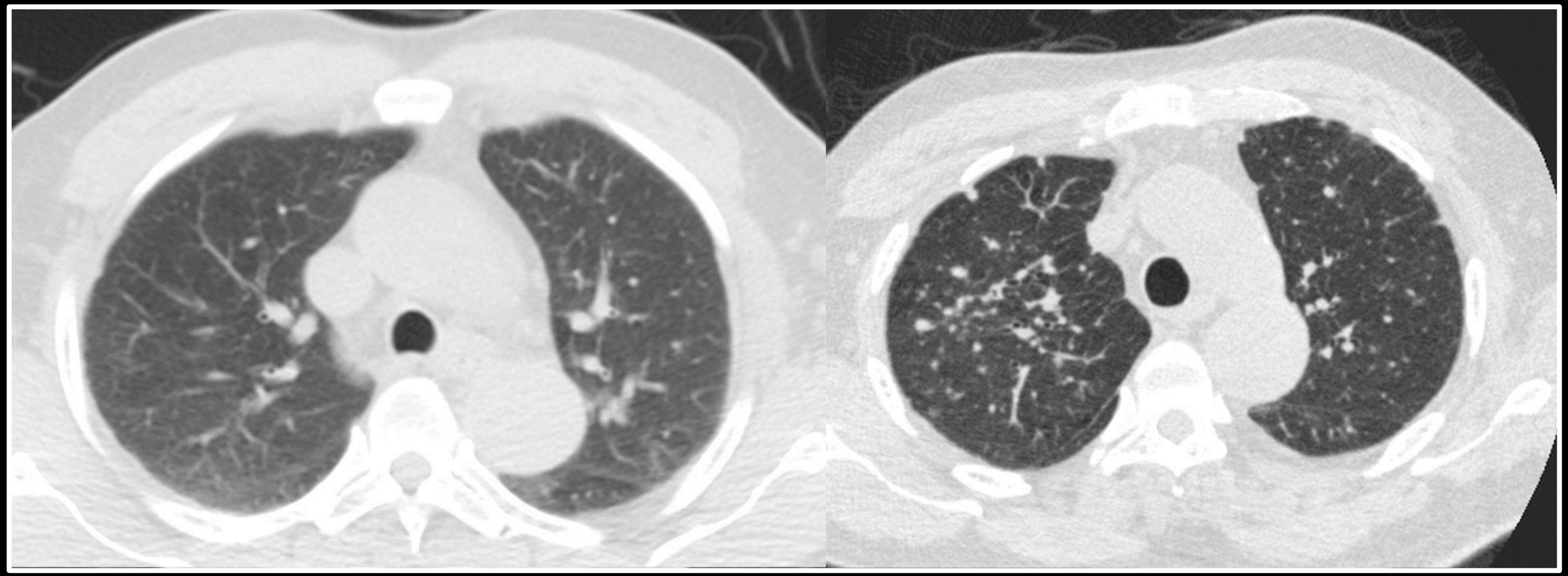
4 months later

Increasing dyspnea after 4 months of treatment

Baseline

4 months later

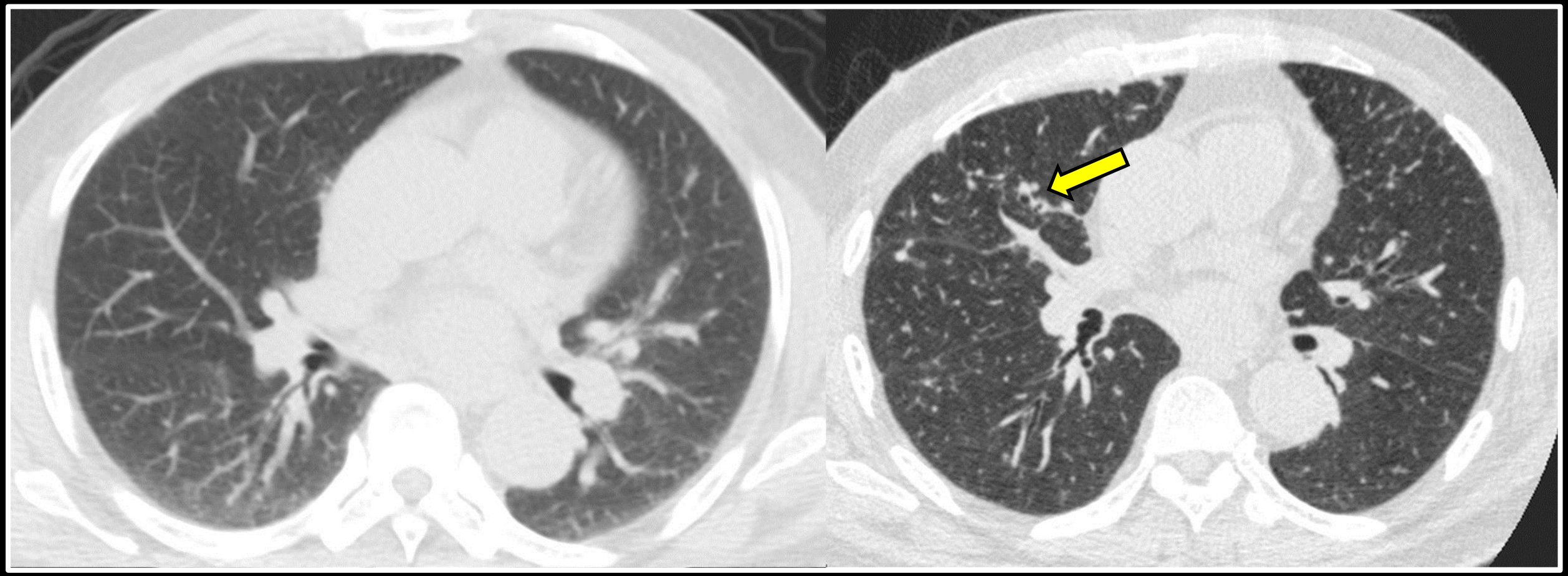
Increasing dyspnea after 4 months of treatment



Baseline

4 months later

Increasing dyspnea after 4 months of treatment



Baseline

4 months later

Increasing dyspnea after 4 months of treatment

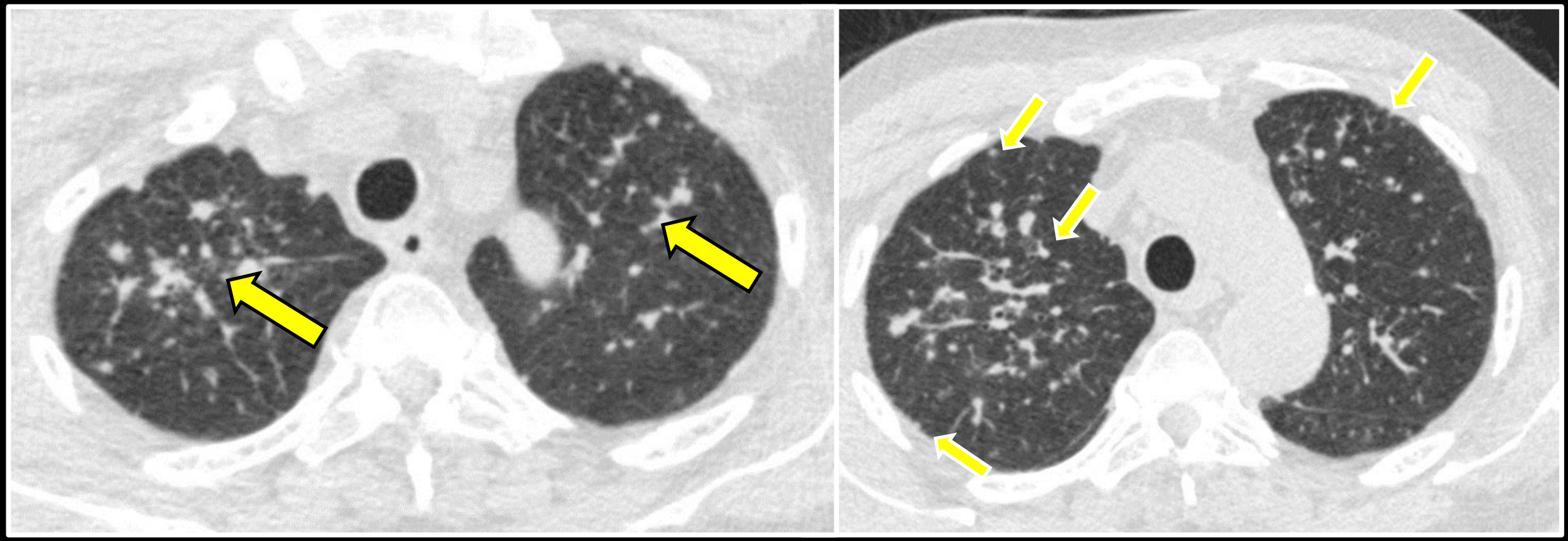
Baseline

4 months later

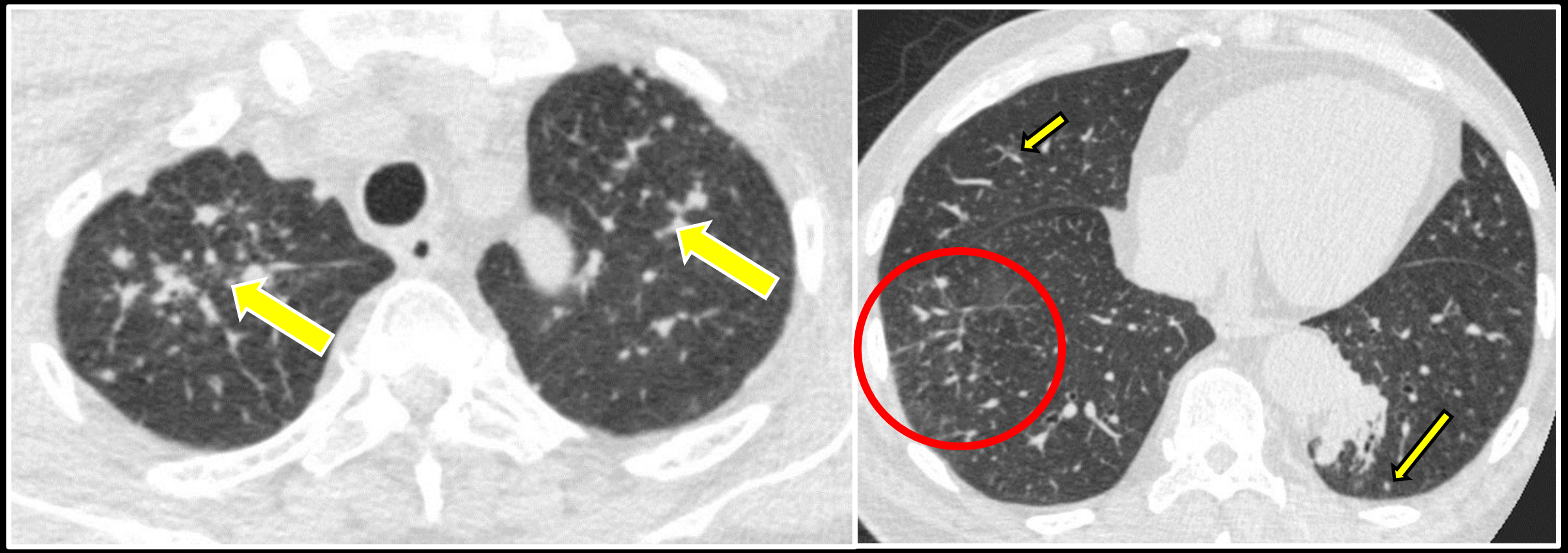
Imaging Findings

CT: Multiple small nodules in peri-lymphatic distribution, subpleural, along the bronchovascular bundles, interlobular septum and in a *symmetric and upper zone predominant distribution*

Increasing dyspnea after 4 months of treatment



Increasing dyspnea after 4 months of treatment



Differential Diagnosis

Neoplastic:

1. **Lymphangitis carcinomatosa:** ADK (breast, lung, stomach)
2. **Lymphoproliferative disease**
3. **Pulmonary tumor thrombotic microangiopathy (PTTM):**
   Gastric cancer is the most commonly associated malignancy

Infection:

1. **Mycobacteria / Fungi**

Differential Diagnosis

Inflammatory / Granulomatous:

1. **IgG4 related lung disease:** features are often excellent mimickers of malignancies, infections, and other immune-mediated disorders (vasculitis)
2. **Sarcoidosis / Sarcoid reaction**

2018 RSNA
Image Interpretation Session

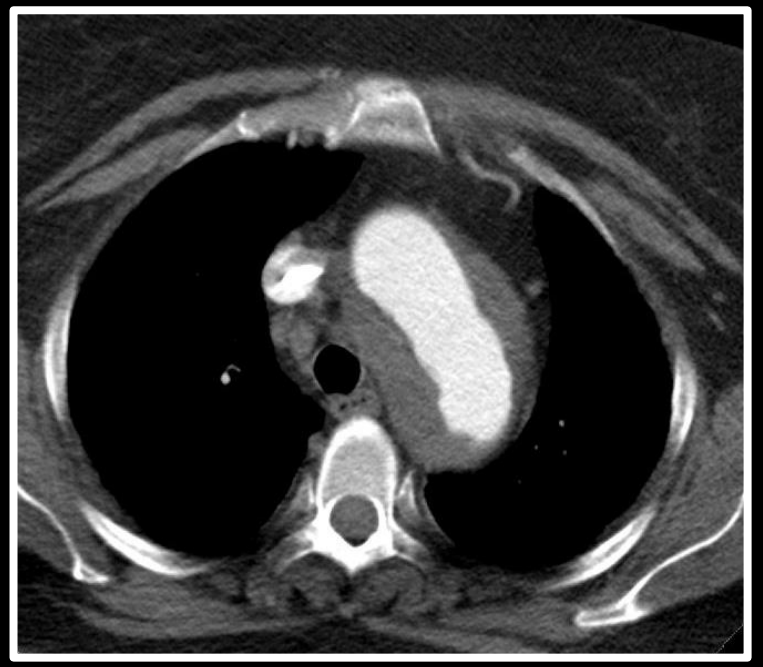
Cardiovascular

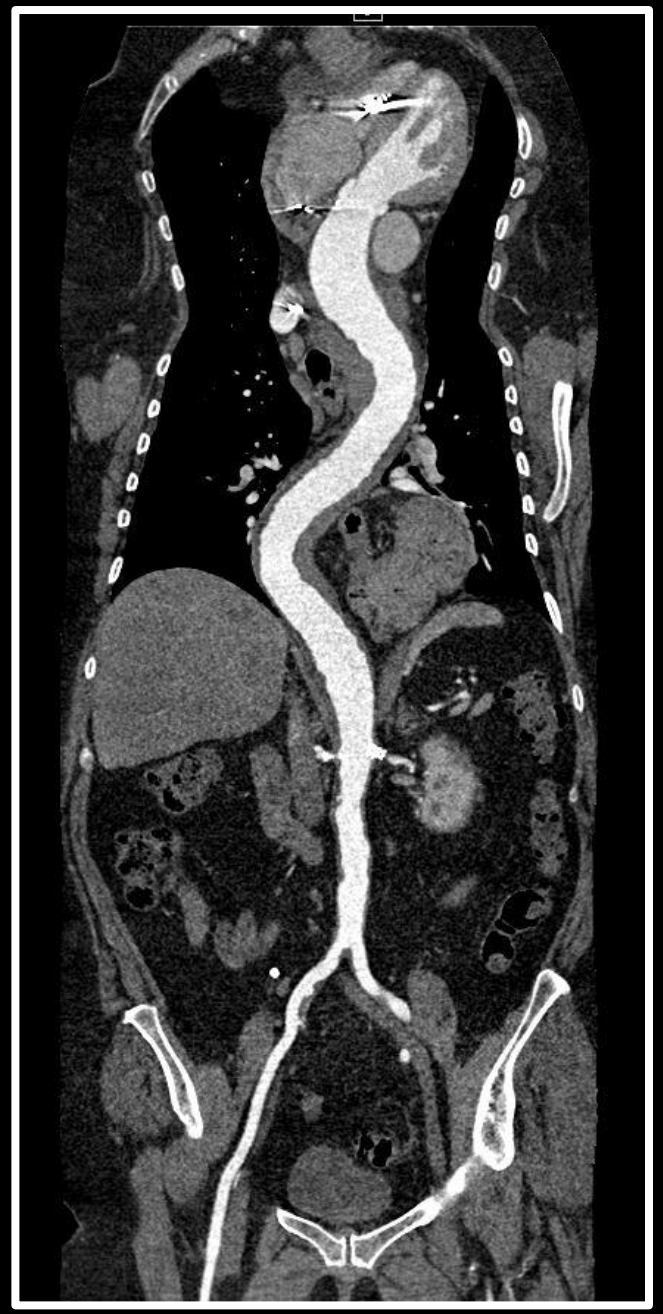
RSNA®

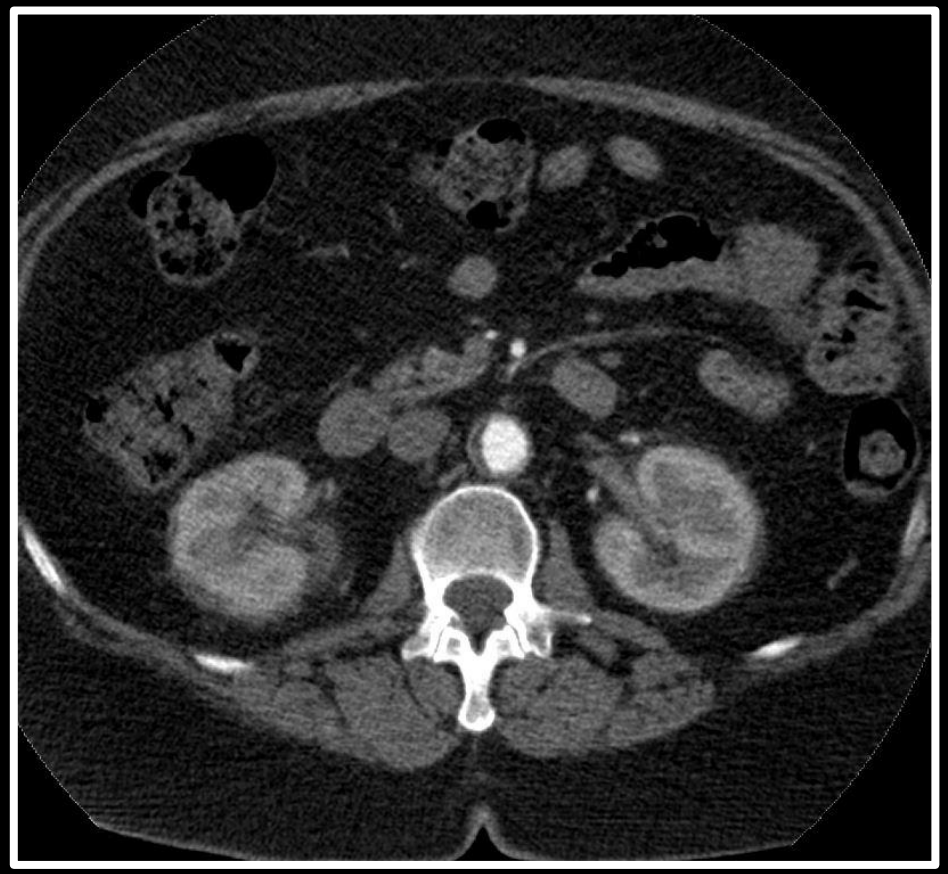
History

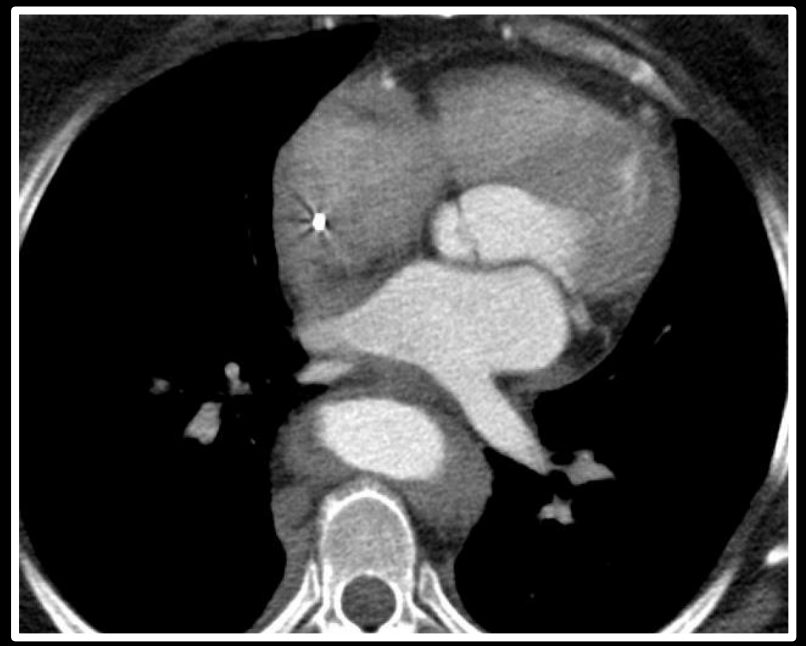
57 year-old female presenting with:

- **3-month history of daily exertional shortness of breath**
- **fatigue, and**
- **non-localized lower back pain**

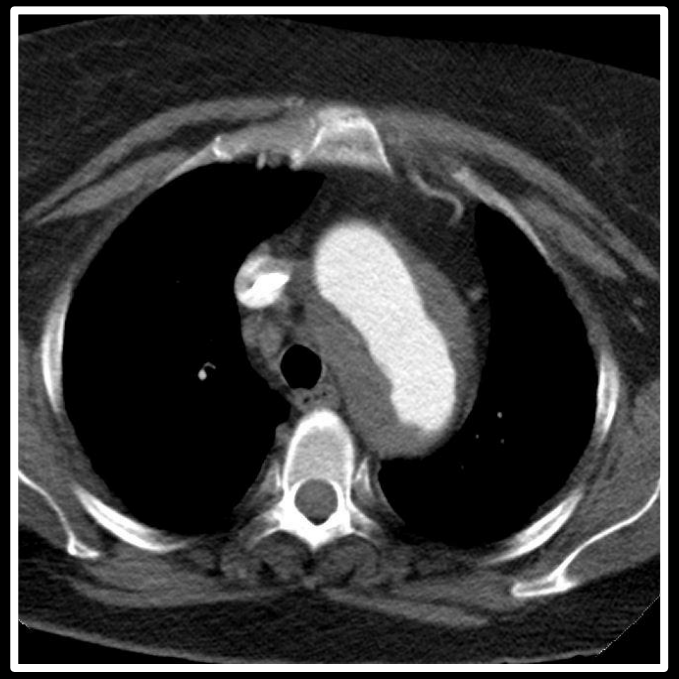


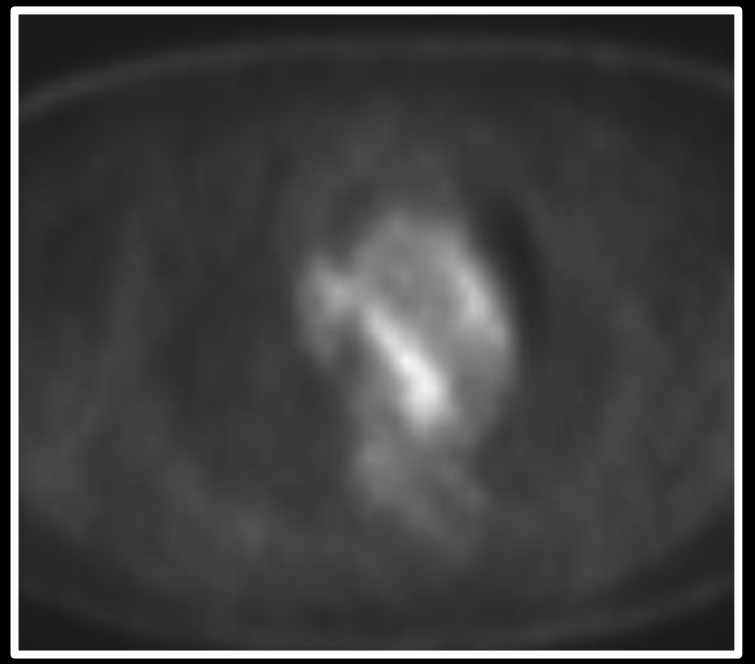


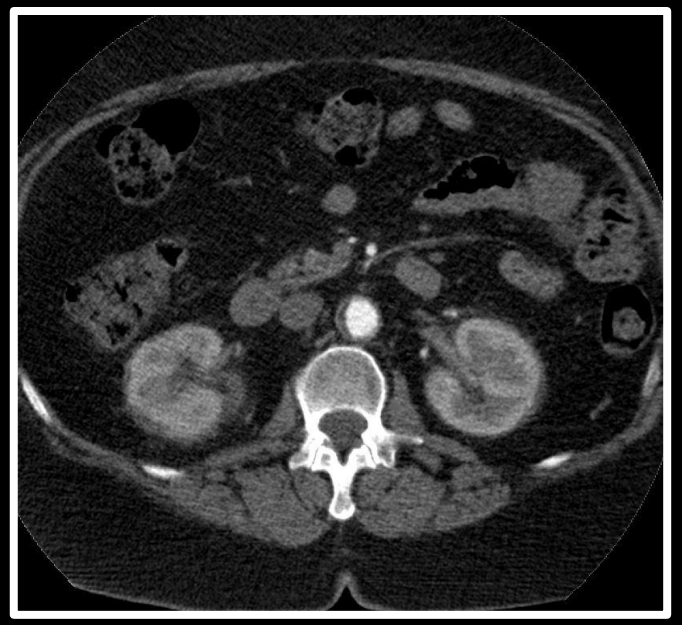


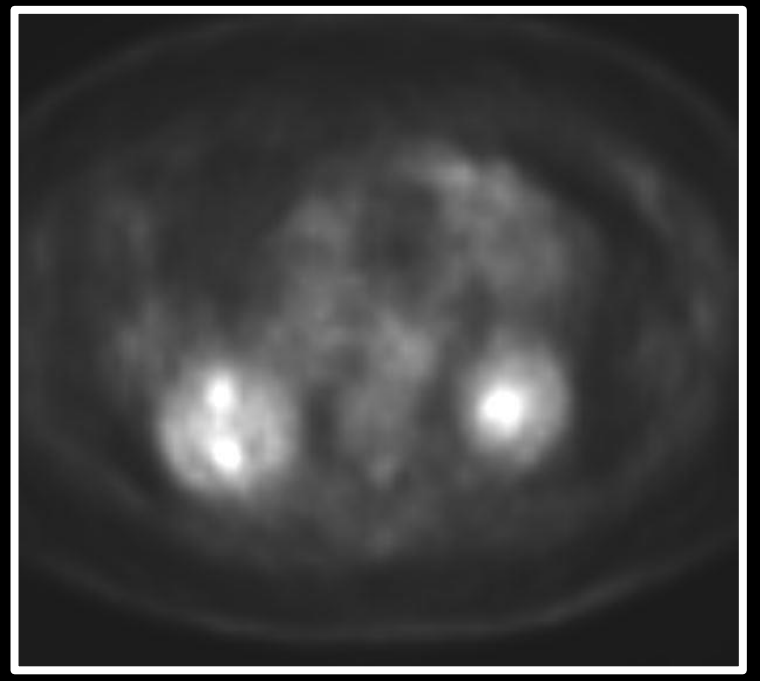


RSNA®









RSNA®

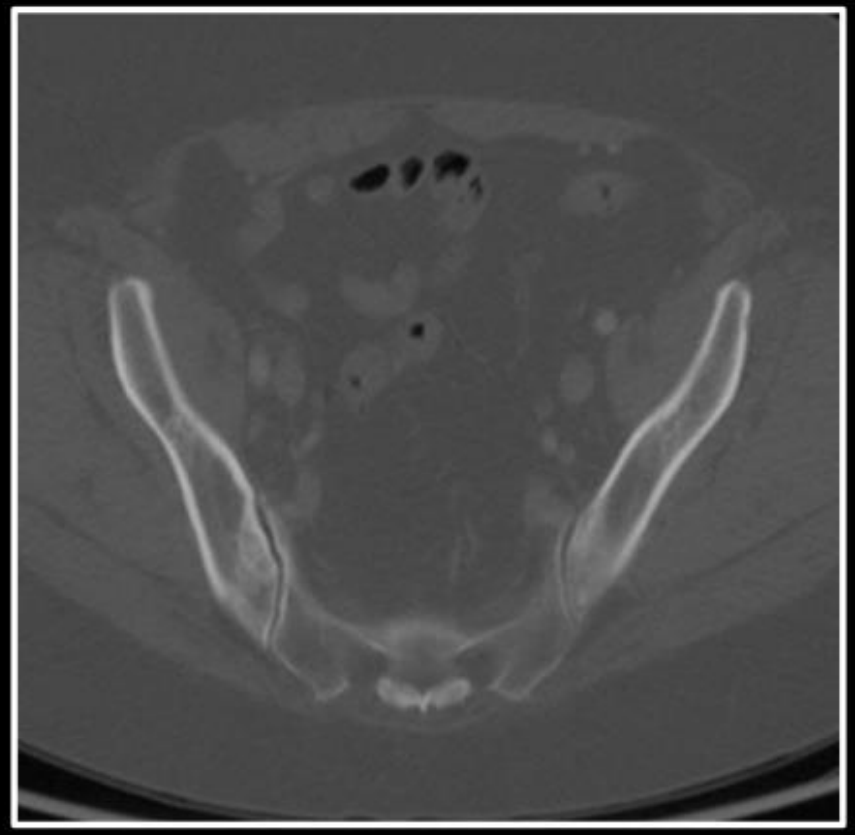
Aortitis – diffuse inflammation of the aorta

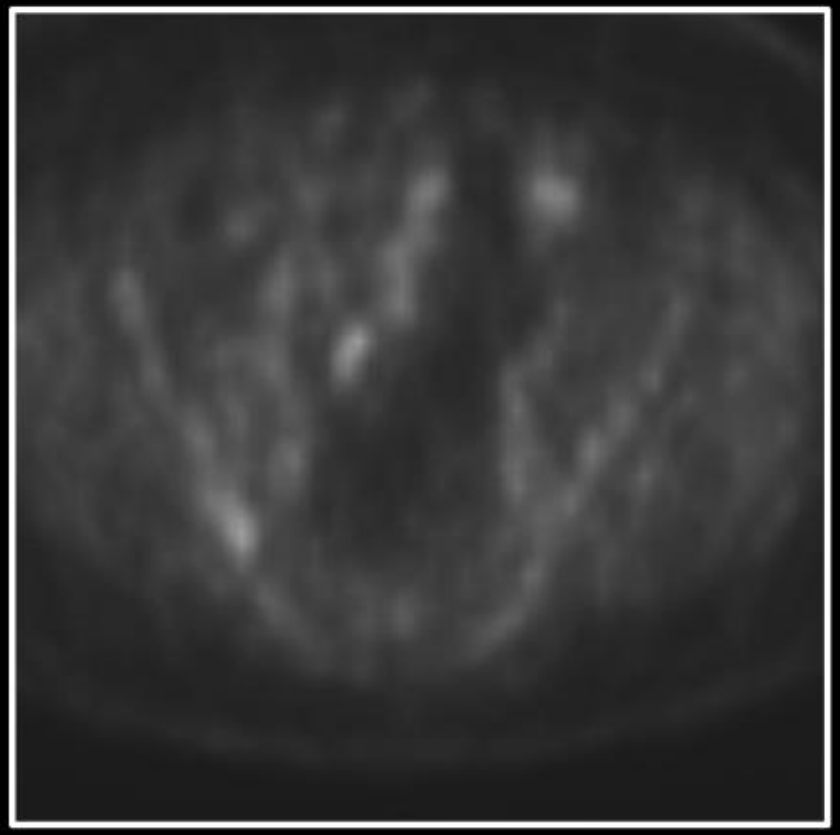
- giant cell arteritis (GCA)
- Takayasu arteritis
- Cogan's syndrome
- systemic lupus erythematosus/rheumatoid arthritis
- HLA-B27 associated spondyloarthropathies (Reiter’s and ankylosing spondylosis)
- ANCA-associated vasculitides (Wegener’s, microscopic polyangiitis (MPA), and eosinophilic granulomatosis with polyangiitis (EGPA), previously known as Churg-Strauss)
- Behçet's disease
- sarcoidosis
- infectious (tuberculosis, syphilis, salmonella and other bacteria)
- idiopathic retroperitoneal fibrosis (Ormond’s disease)/inflamed abdominal aortic aneurysm
- Erdheim-Chester
- idiopathic isolated

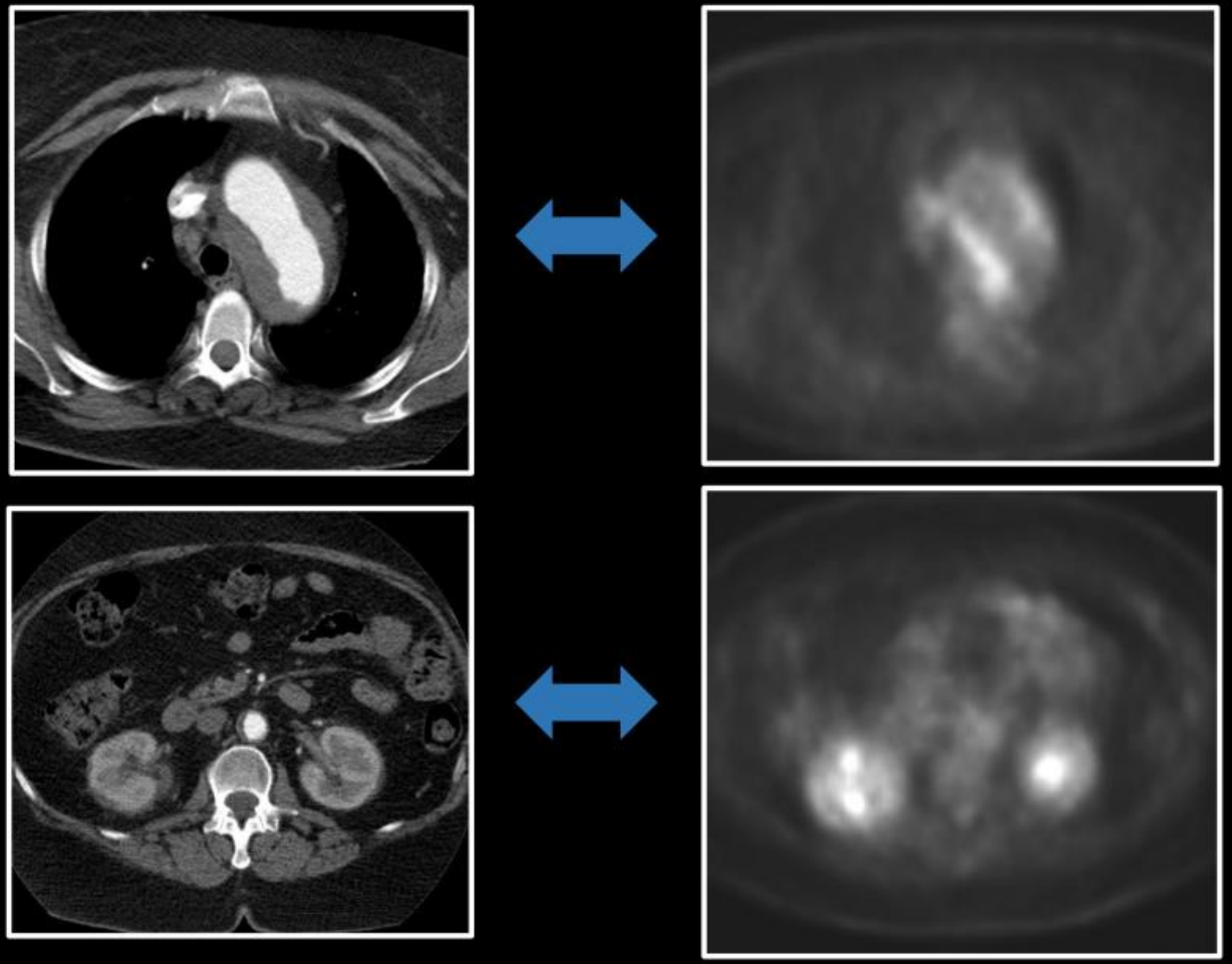
Exertional SOB

- Lung – SLE, RA, sarcoid, HLA-B27 associated, ANCA-associated vasculitides, Behçet's, infectious, giant cell arteritis
- Cardiac – giant cell, Takaysu, Cogan’s, SLE, sarcoid, HLA-B27 associated, ANCA-associated, Behçet's, infectious

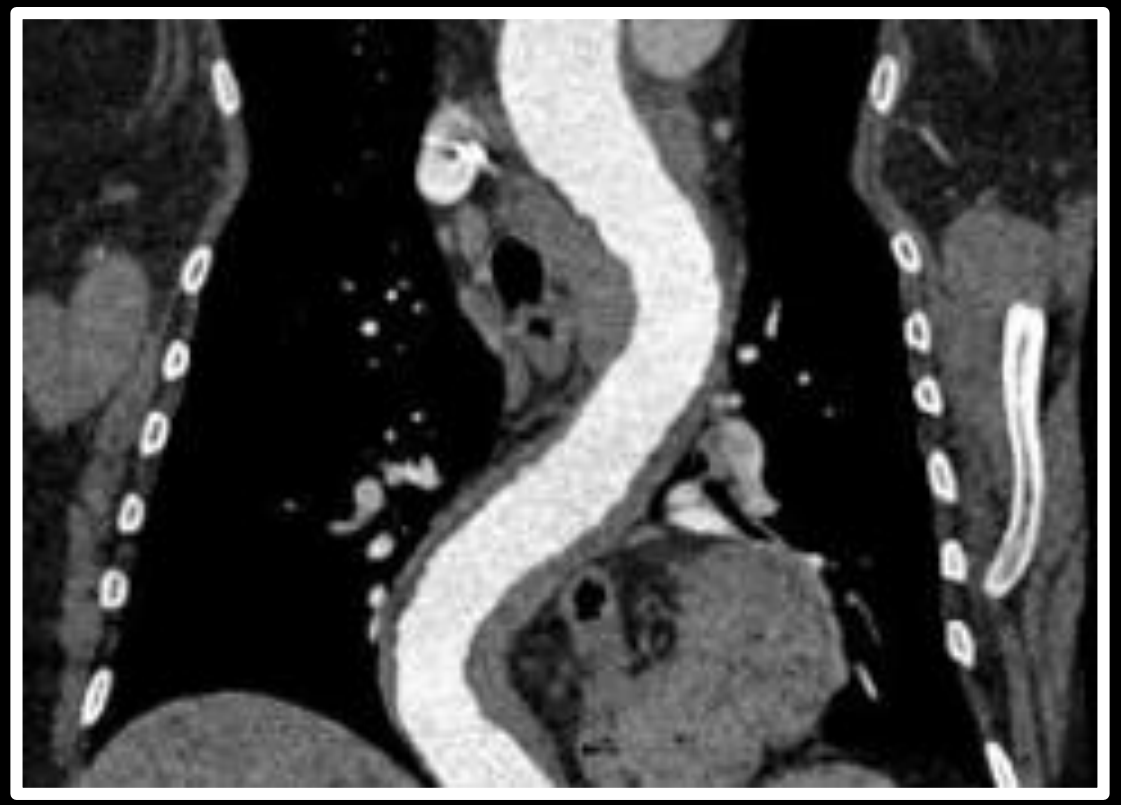
Back pain? Sacroiliac joint, other bone involvement?

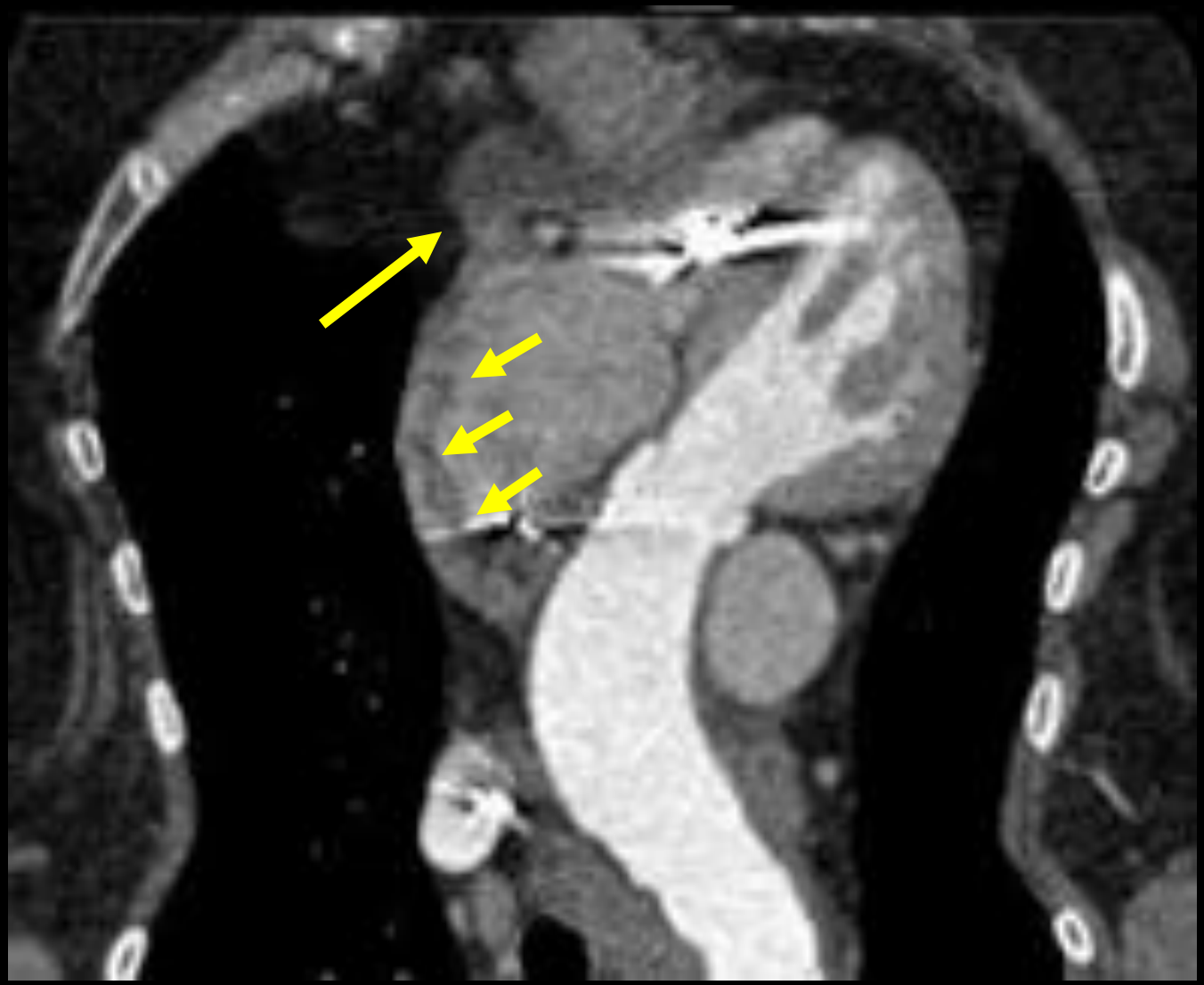






“Coated aorta”





2018 RSNA
Image Interpretation Session

Abdomen: GI

RSNA®

History

- 66 year-old male with chronic abdominal pain
- Acute exacerbation
- Chronic medical history, includes
  - Gout
  - Hypertension
  - “Congenital emphysema”: Rx inhalers and prn steroids
    - Recurrent pneumothoraces
    - Recurrent infections
    - Chronically short of breath

History

- Relevant Surgical history
  - Bilateral carpal tunnel releases; right side 1970's
  - Bilateral finger amputations: etiology?
  - Hx of intussusception: small bowel resection

- **Relevant Surgical history**
  - **Bilateral carpal tunnel releases; right side 1970's**
  - **Bilateral finger amputations: etiology?**

Findings: X-ray

- Third finger amputation
- Macrodactyly (disproportionate overgrowth)
- Course trabeculation of enlarged phalanxes
- Soft tissue hypertrophy (metacarpus and around second digit)
- Abnormally calcified connective tissue

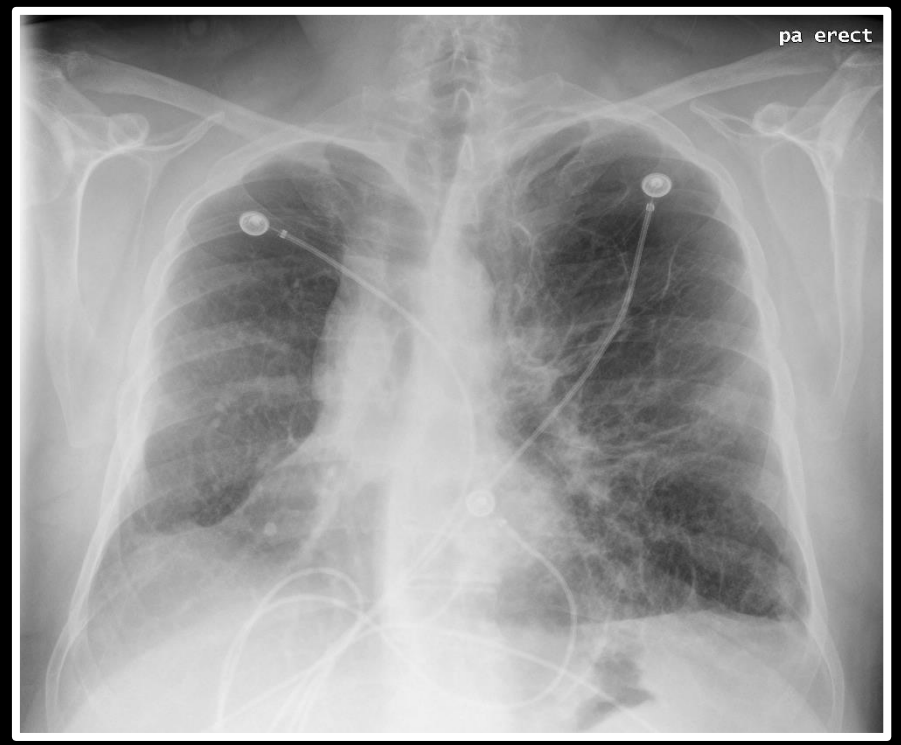
Findings: MR

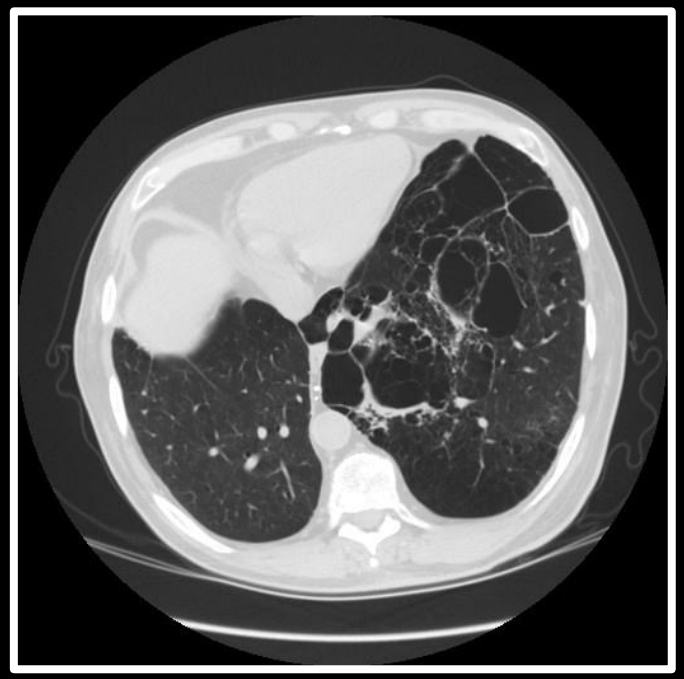
- Soft-tissue fibrotic lesion (low signal on T1/T2), i.e. fibrous hamartoma
- Bone cystic lesions

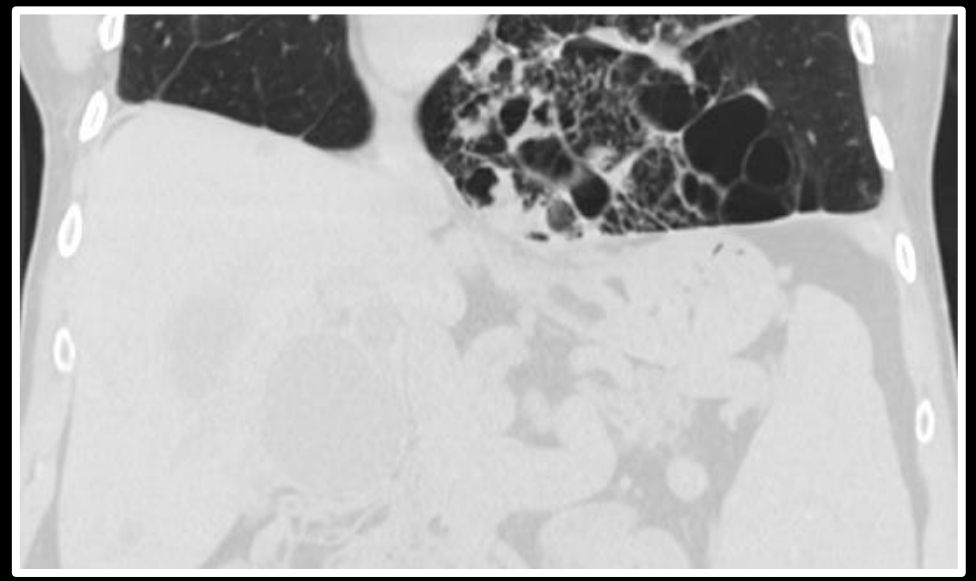
Findings

- Overgrowth of connective tissues (bone, fat)
- Progressive disease
- Onset at young age

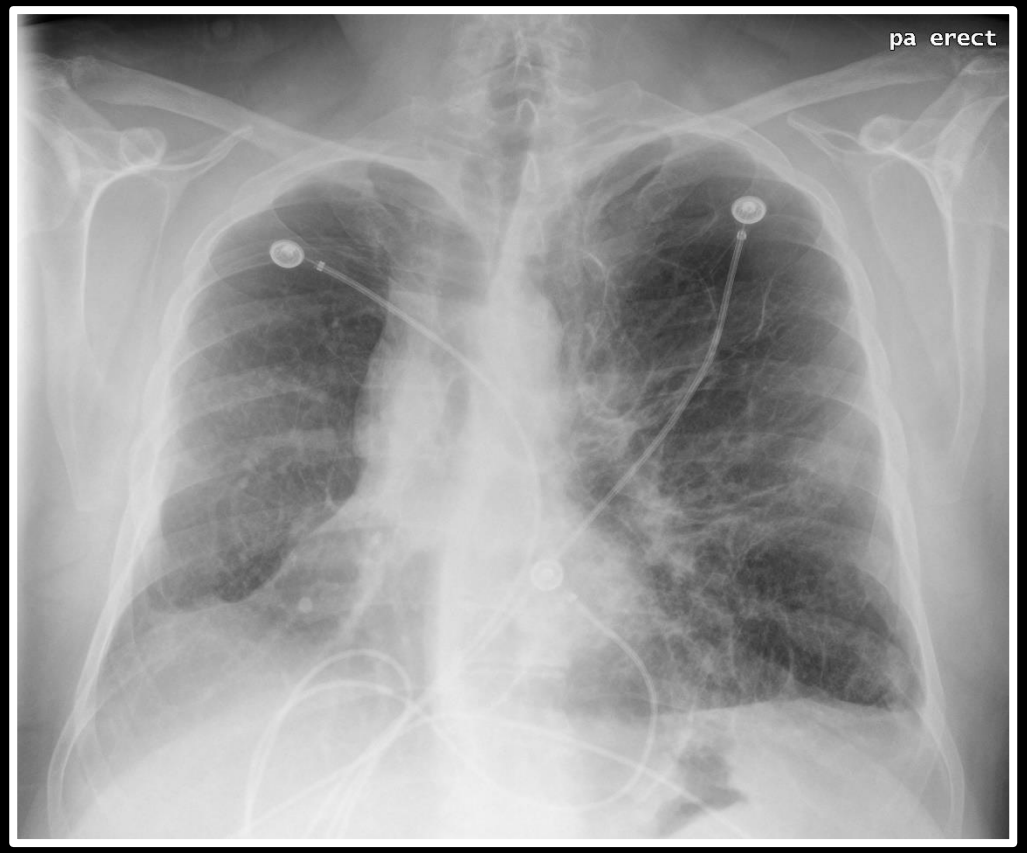
- “Congenital emphysema”: Rx inhalers and prn steroids
  - Recurrent pneumothoraces
  - Recurrent infections
  - Chronically short of breath



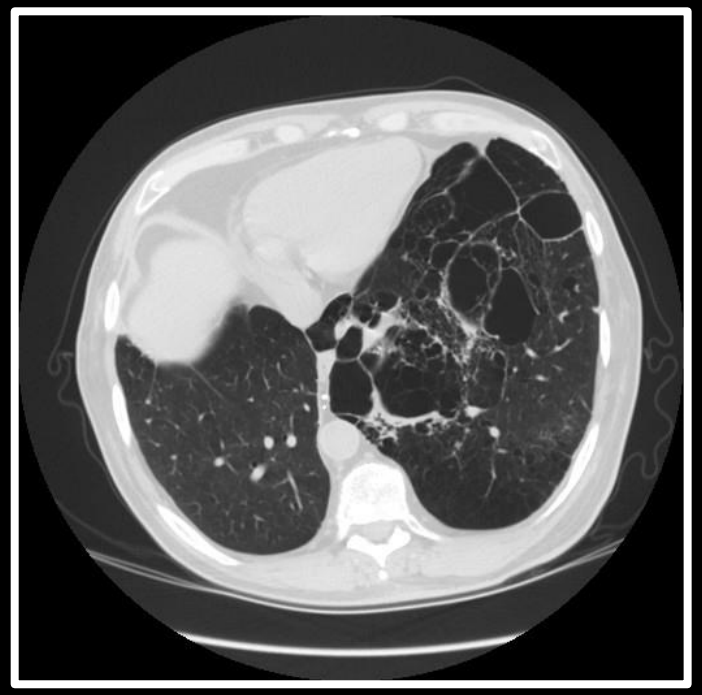


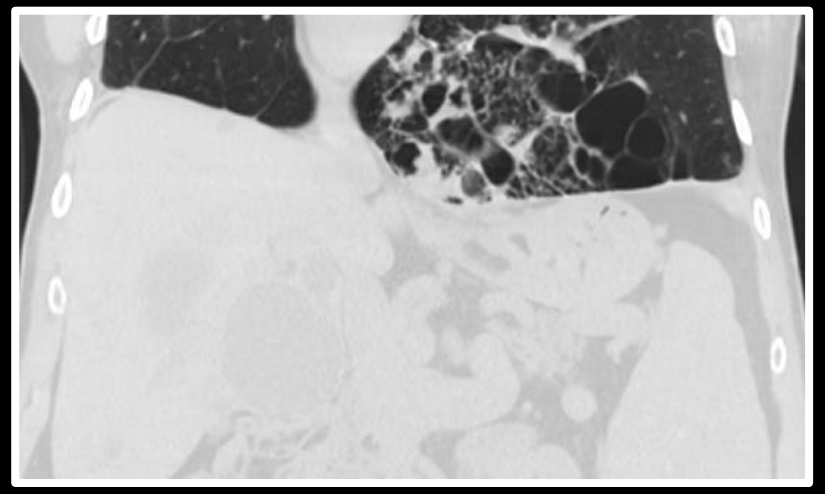


Findings



- Chest X-ray
  - Asymmetric hemithoraces; hyperinflation of left lung
  - Redistribution of blood flow to the upper lung zones with abnormal enlargement of the upper lobe vessels
  - Prominent hila with reticular and streaky densities in both perihilar areas



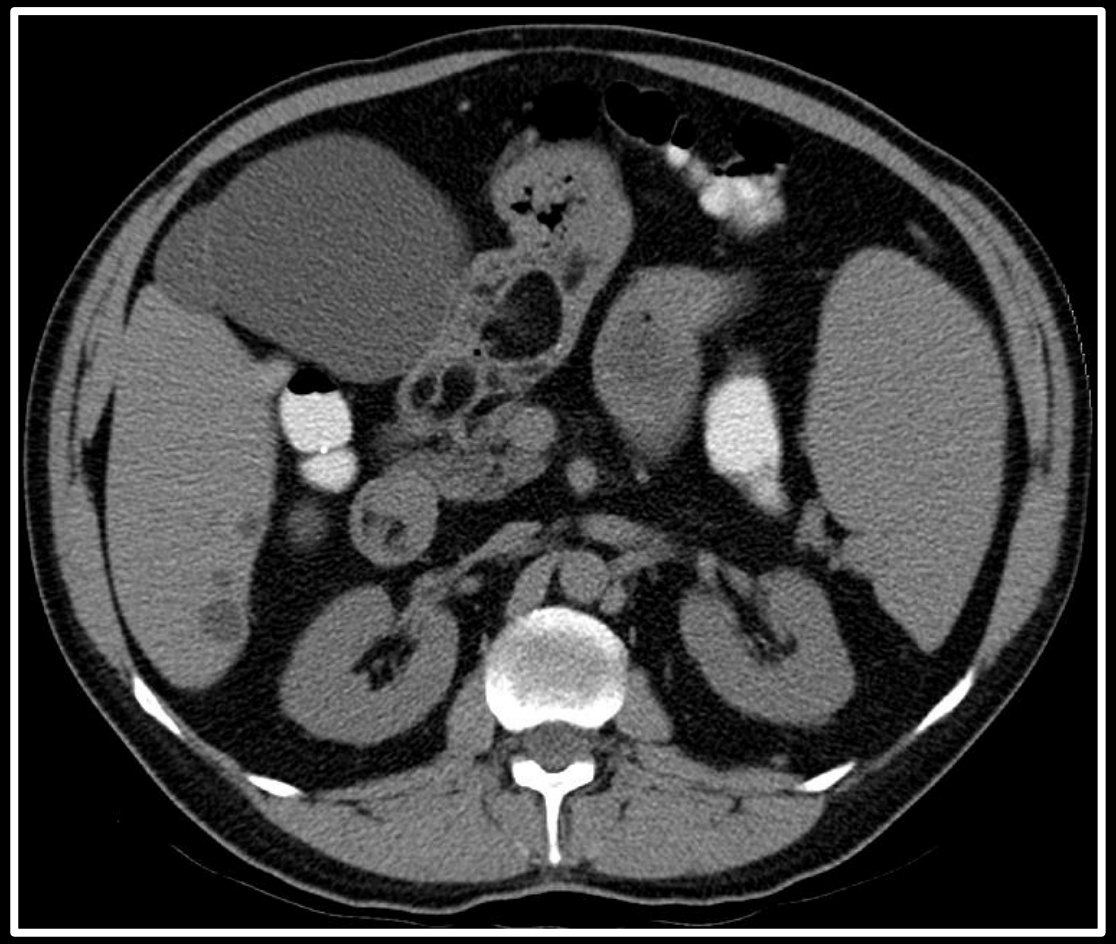


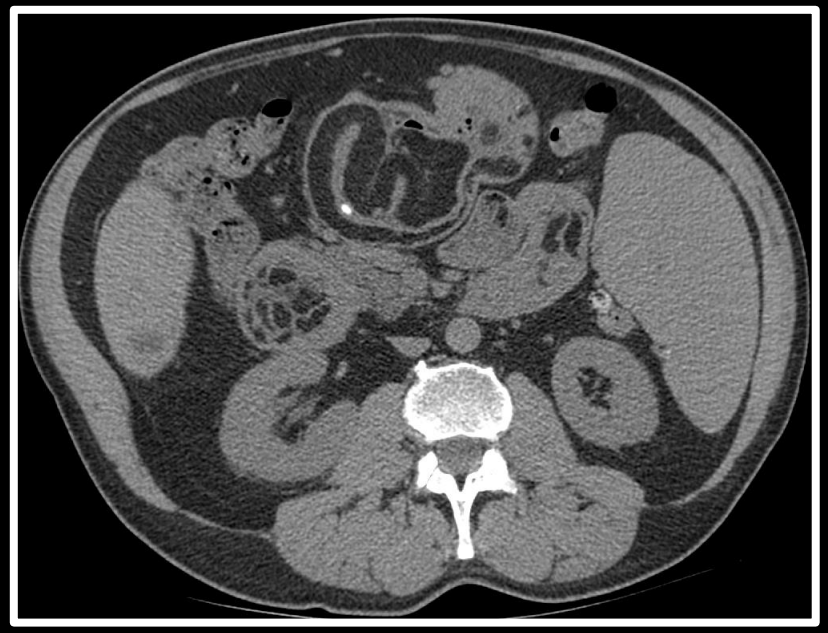
Findings

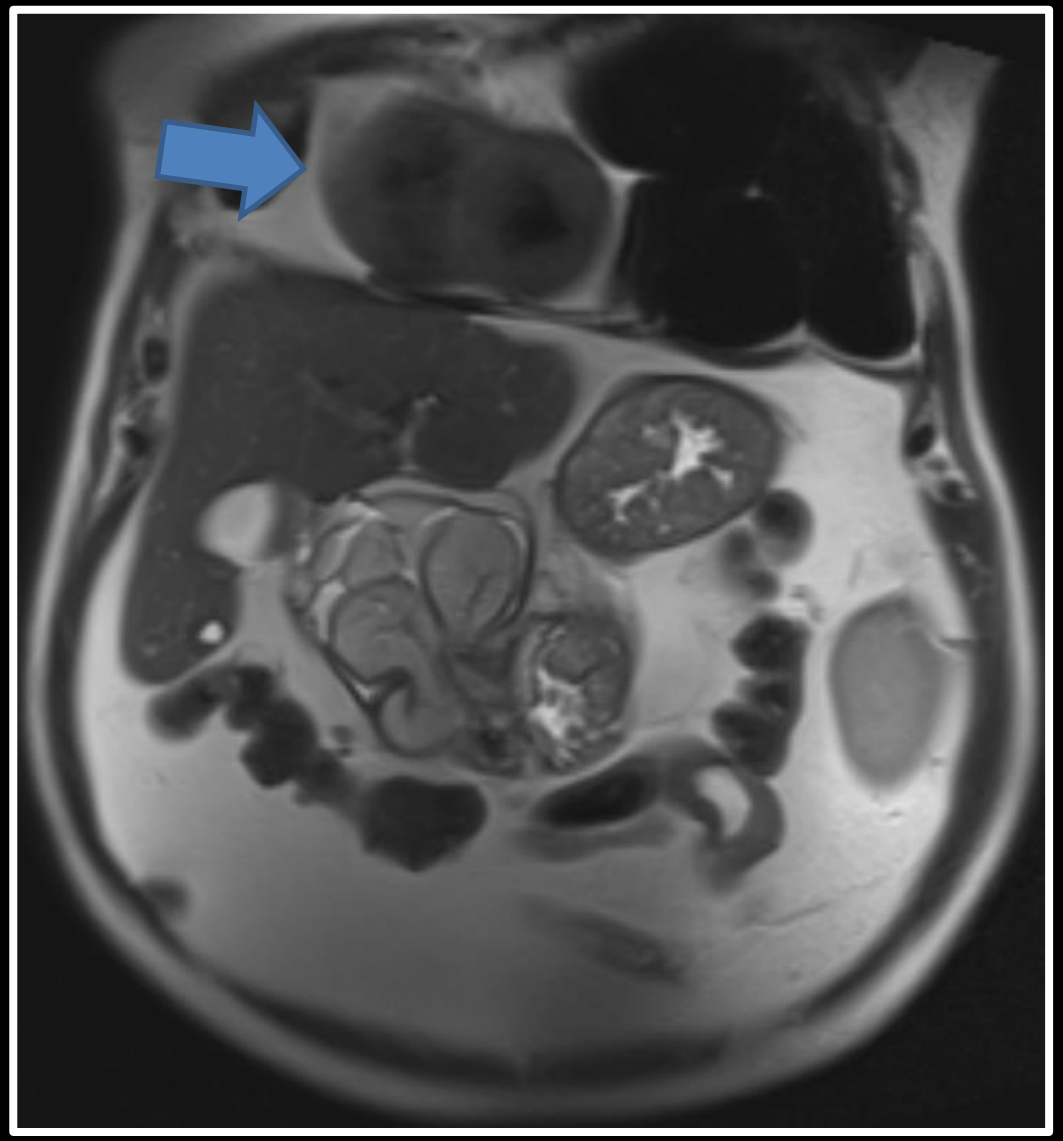
- Lung CT
  - Hyperinflation of the left lung
  - Emphysematous changes
  - Areas of scarring and cystic changes in the left lower lobe

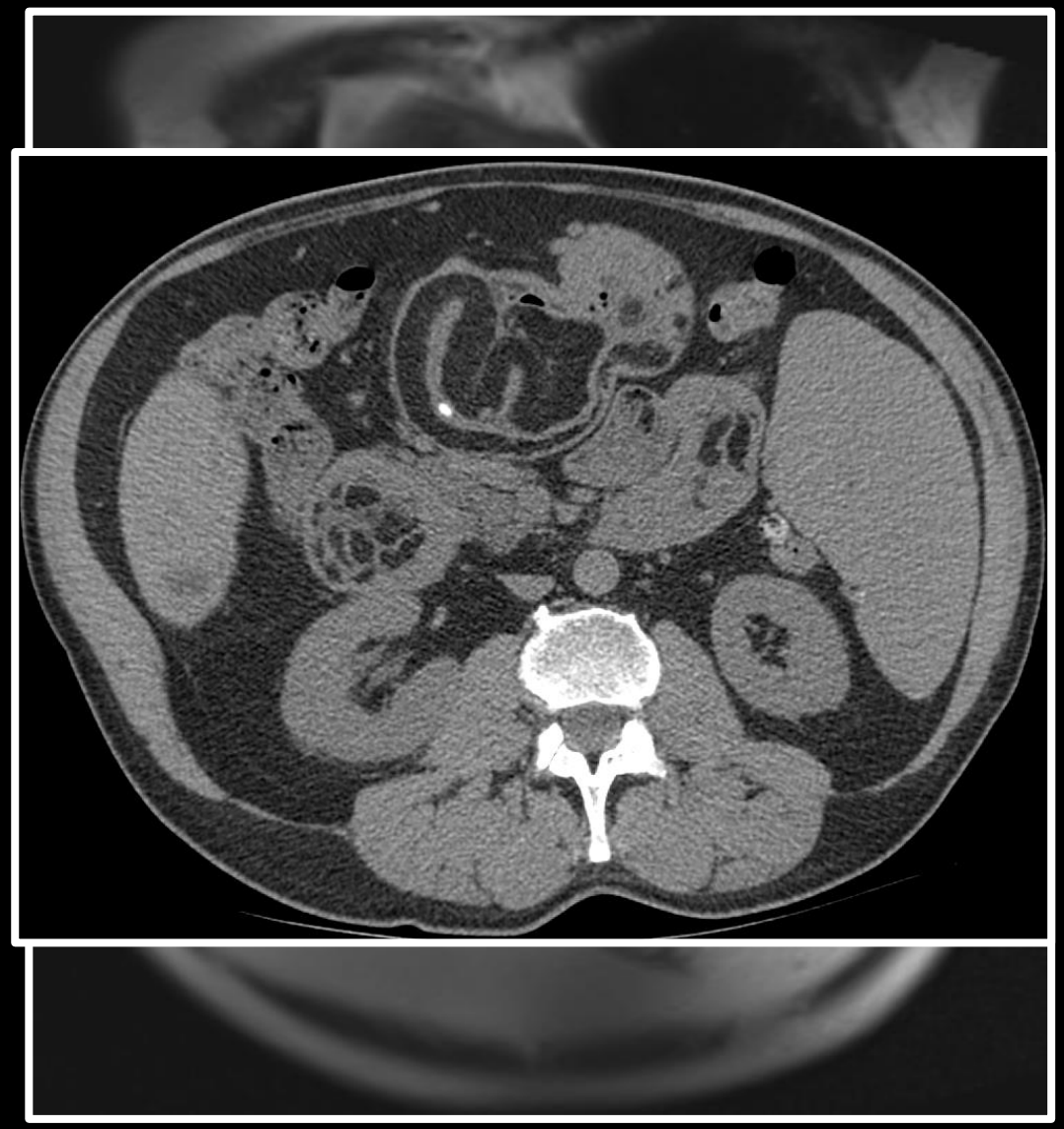
History

- **Hx of intussusception: small bowel resection**









Findings

- Multiple encapsulated lipomas in the stomach, duodenum and jejunum
- Fatty overgrowth in the omentum
- Lipohypoplasia of subcutaneous fat
- Dysregulated adipose tissue
- Splenomegaly
- ?Thick wall of the right ventricle

DIFFERENTIAL DIAGNOSIS

- Macrodystrophia lipomatosa
- Multiple symmetric lipomatosis (Madelung disease)
- CLOVE (Congenital Lipomatous Overgrowth, Vascular malformations, and Epidermal nevi, Skeletal) syndrome
- Proteus syndrome

2018 RSNA
Image Interpretation Session

Abdomen: GU

RSNA®

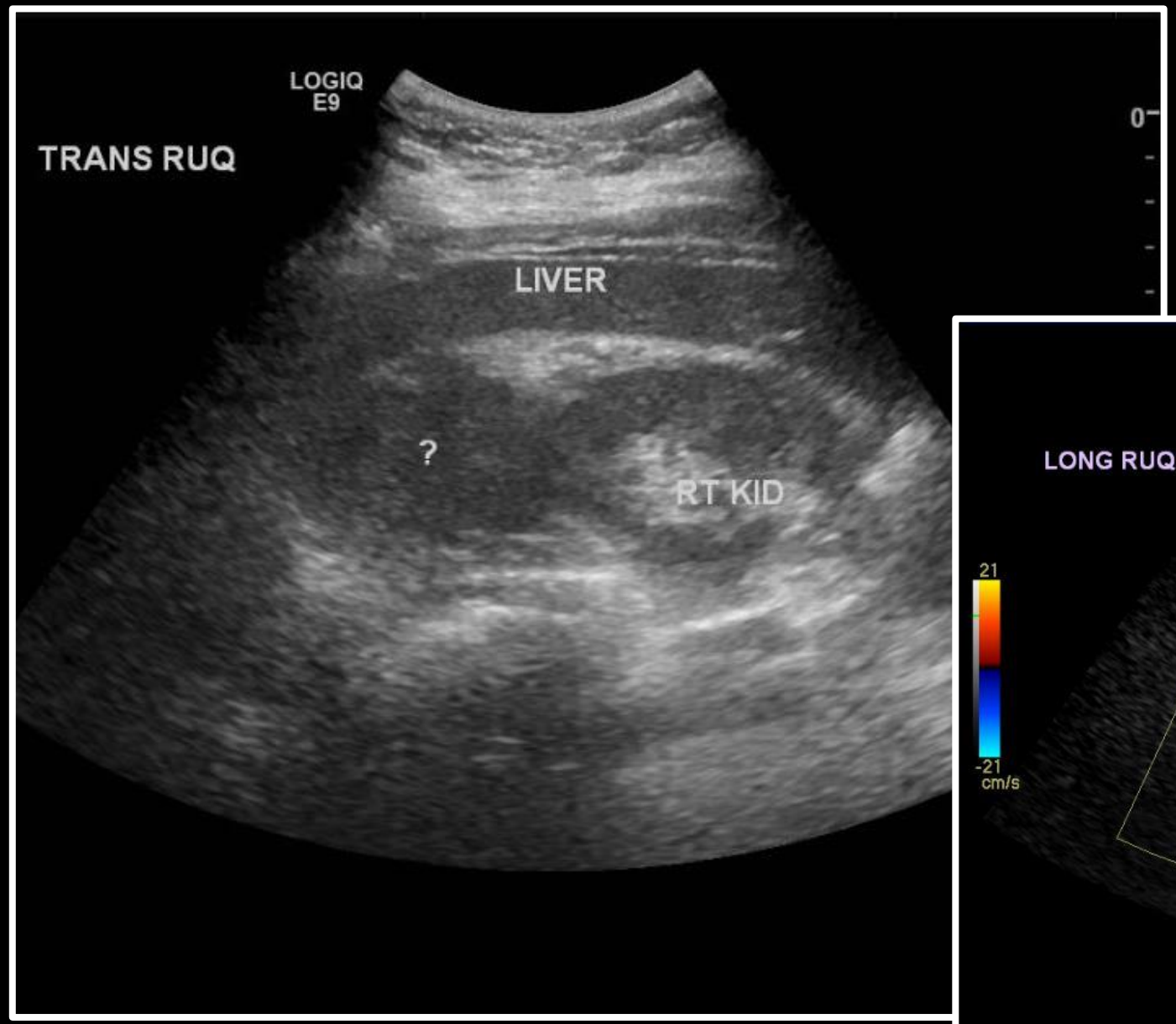
History

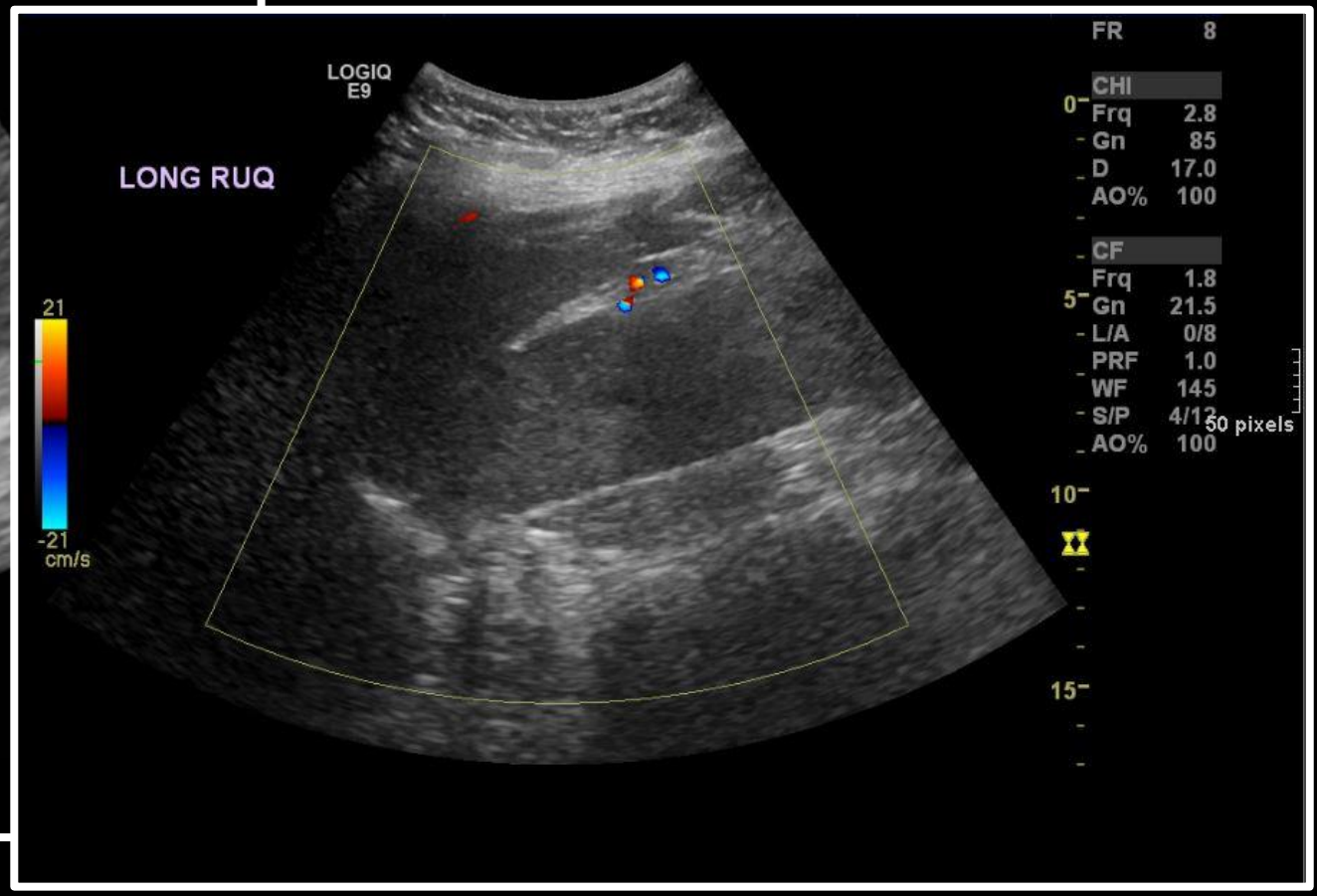
63 year-old female with:

- right abdomen/flank pain
- long standing history of seizures
- 5.0 kg unintentional weight loss

Ultrasound Found:

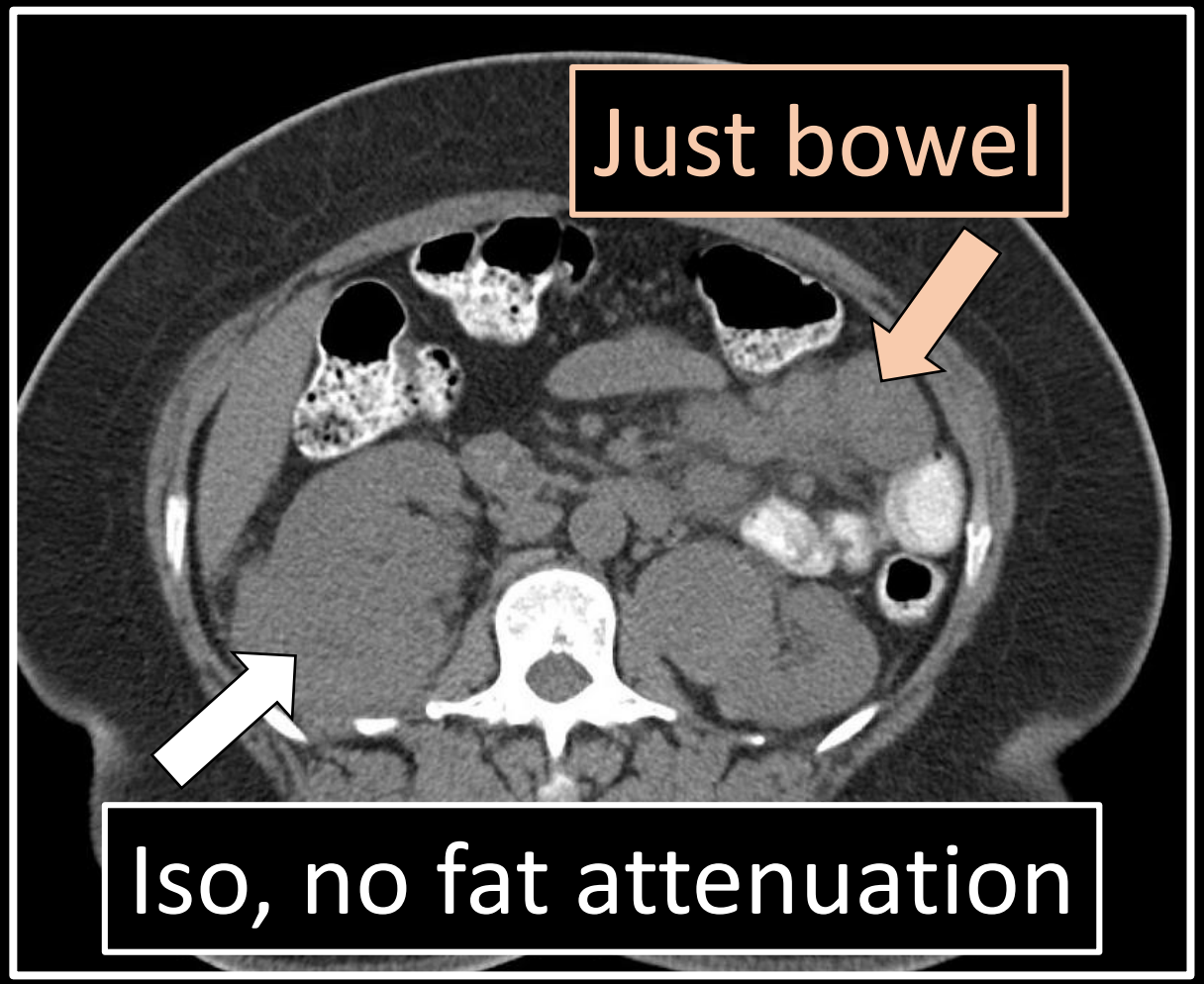
A thing.

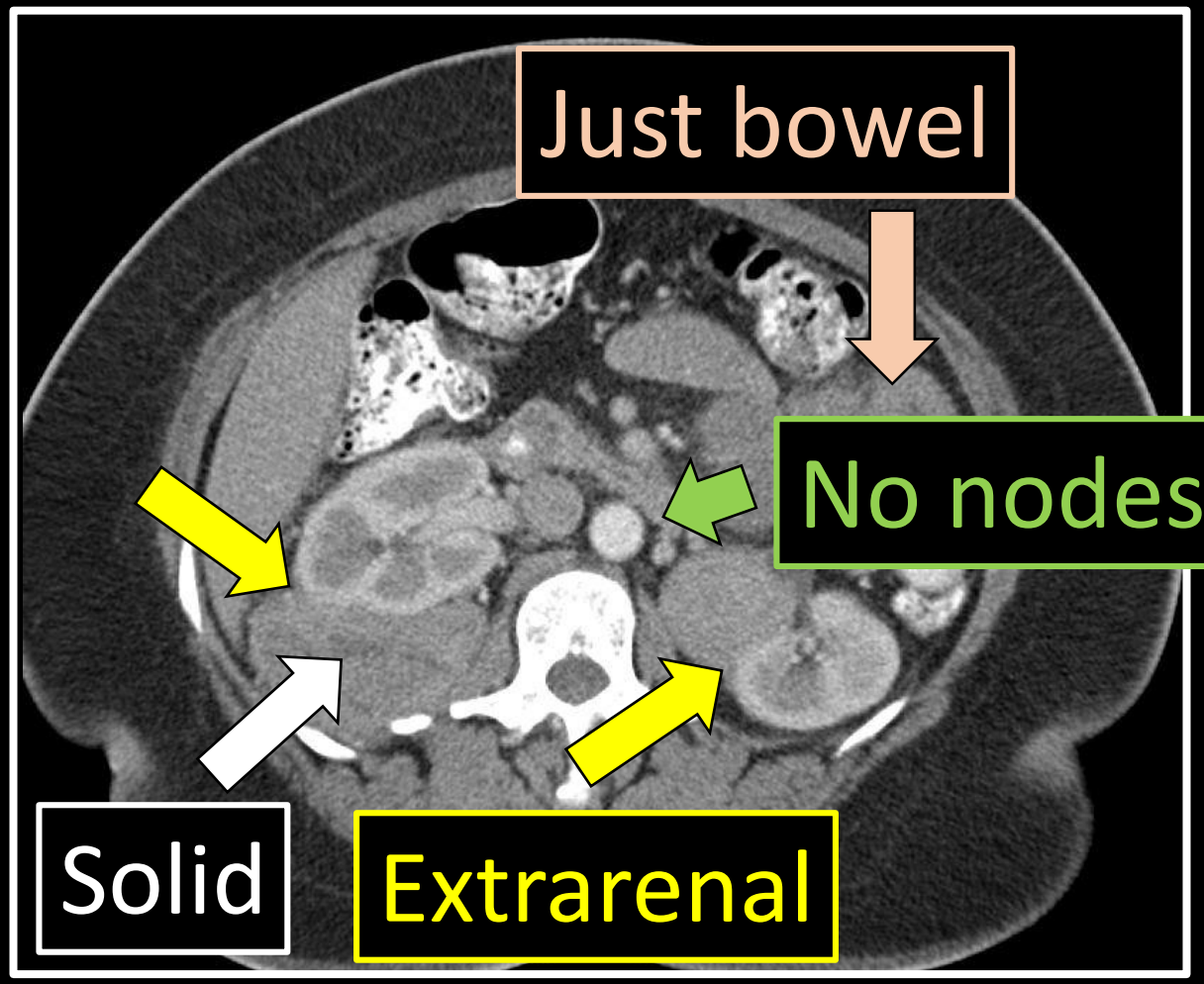


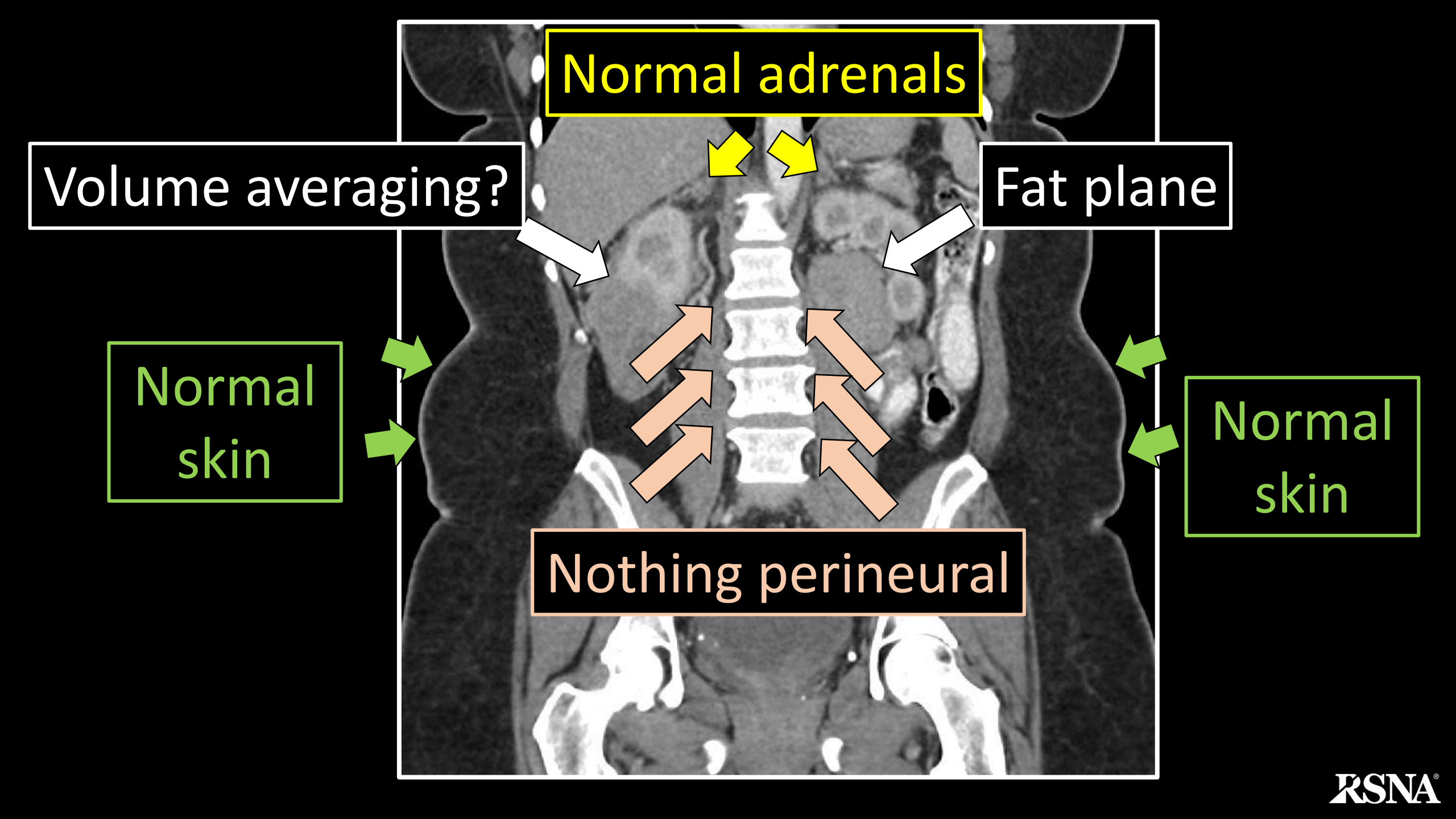


RSNA®

CT shows: Large bilateral solid perinephric masses

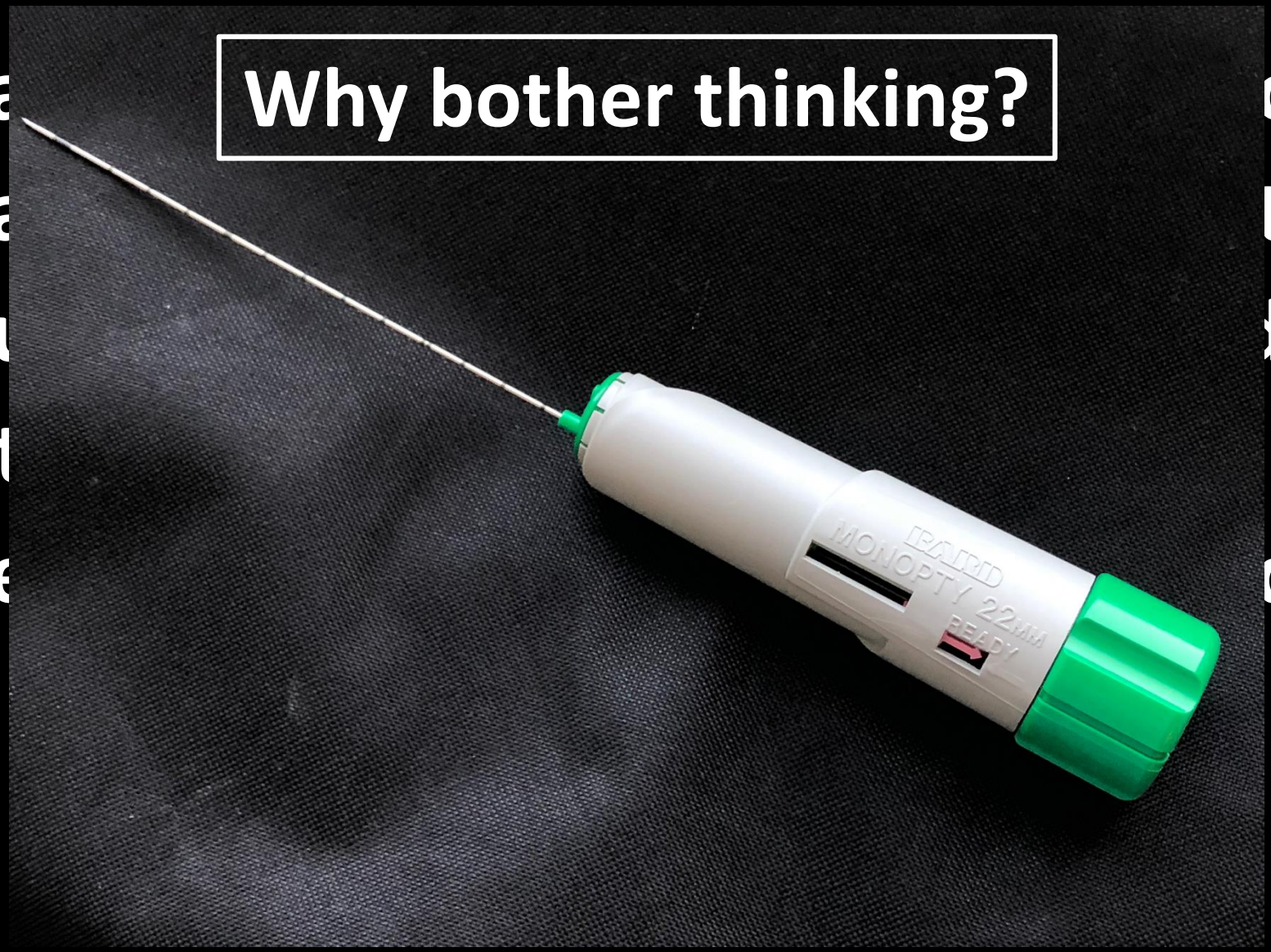





Normal adrenals
Volume averaging?
Fat plane
Normal skin
Normal skin
Nothing perineural

Thought Process

1. Ultra… or that
2. Rena… t DDx
3. Seizu… drome
4. Mult…
5. “Gue… d to me



Perirenal Differential Diagnosis

Perirenal
Lymphoma or mets
Histiocytosis conditions
Plasmacytomas
Paragangliomas
Extramedullary Hematopoesis
Erdheim Chester
Mass-forming IgG4

Neuro-Oncologic Differential Diagnosis

Perirenal
NF-1
vHL
Many others
Tuberous Sclerosis

Some AMLs nasty:
Epithelioid AMLs
(aggressive)

Final Differential and Plan

Reasonable possibilities

--Fat-poor epithelioid AMLs in setting of TS

--Histiocytosis (Rosai-Dorfman [non-Langerhans cell])

--Lymphoma

--Paragangliomas

--Mass-forming IgG4

Plan:

Look at chart (do they have TS?)

Comparisons (esp. CNS)

Metanephrines – if above (-)

Set up for biopsy

2018 RSNA
Image Interpretation Session

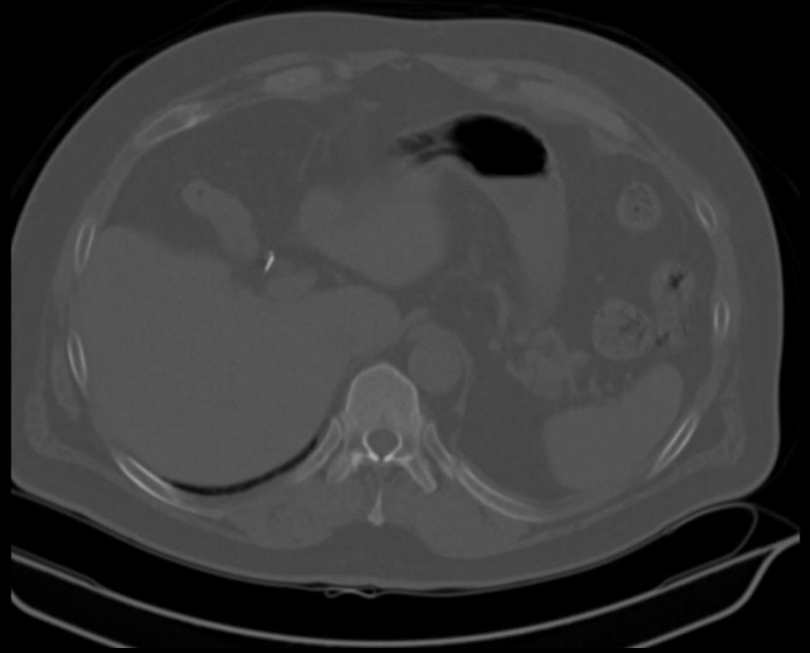
MSK

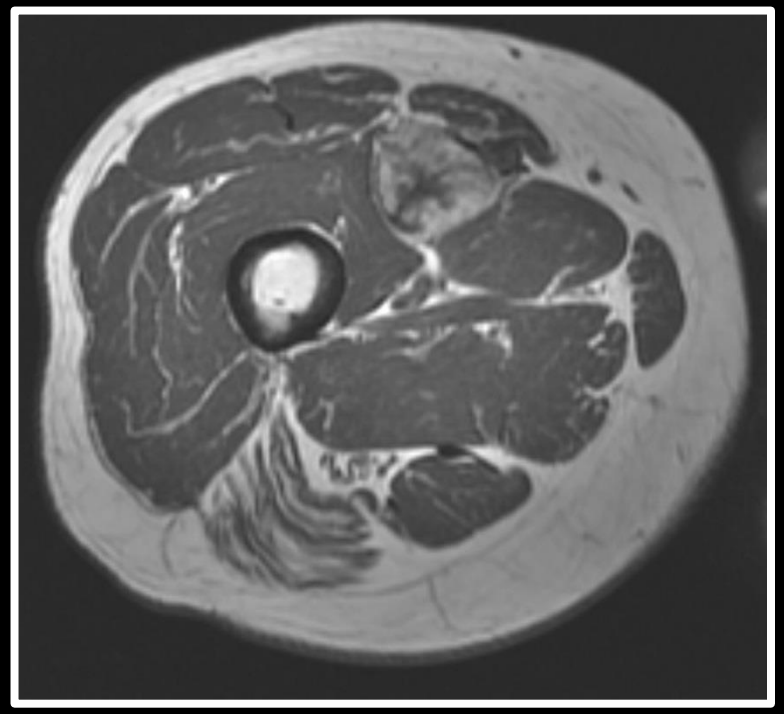
RSNA®

History

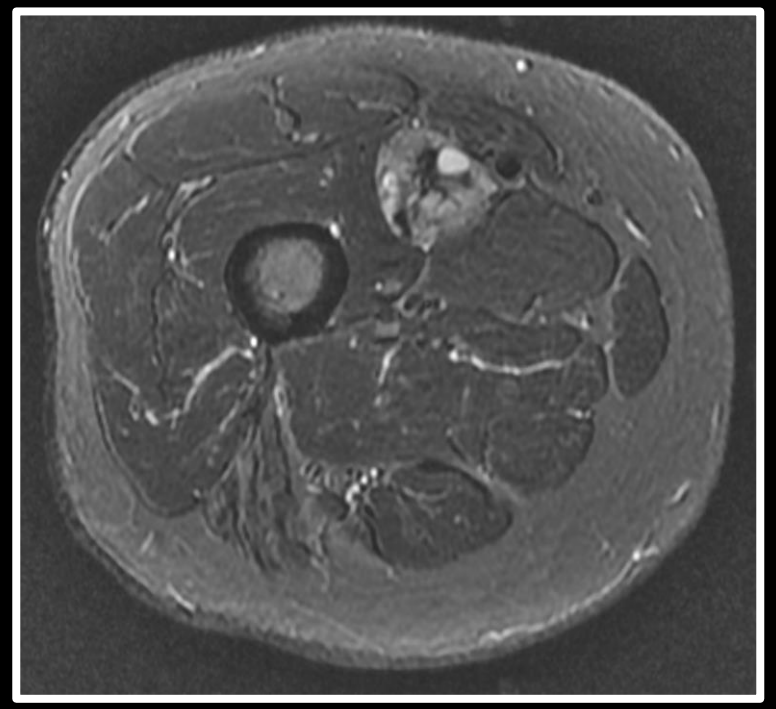
- Male in his 60's
- Several years of generalized pain, fatigue, and muscle weakness with abnormal gait
- History of pubic ramus fractures and rib fractures
- Recent diagnosis of prostate cancer
  - Watchful waiting
- 2-3 year history of pain and discomfort in right thigh





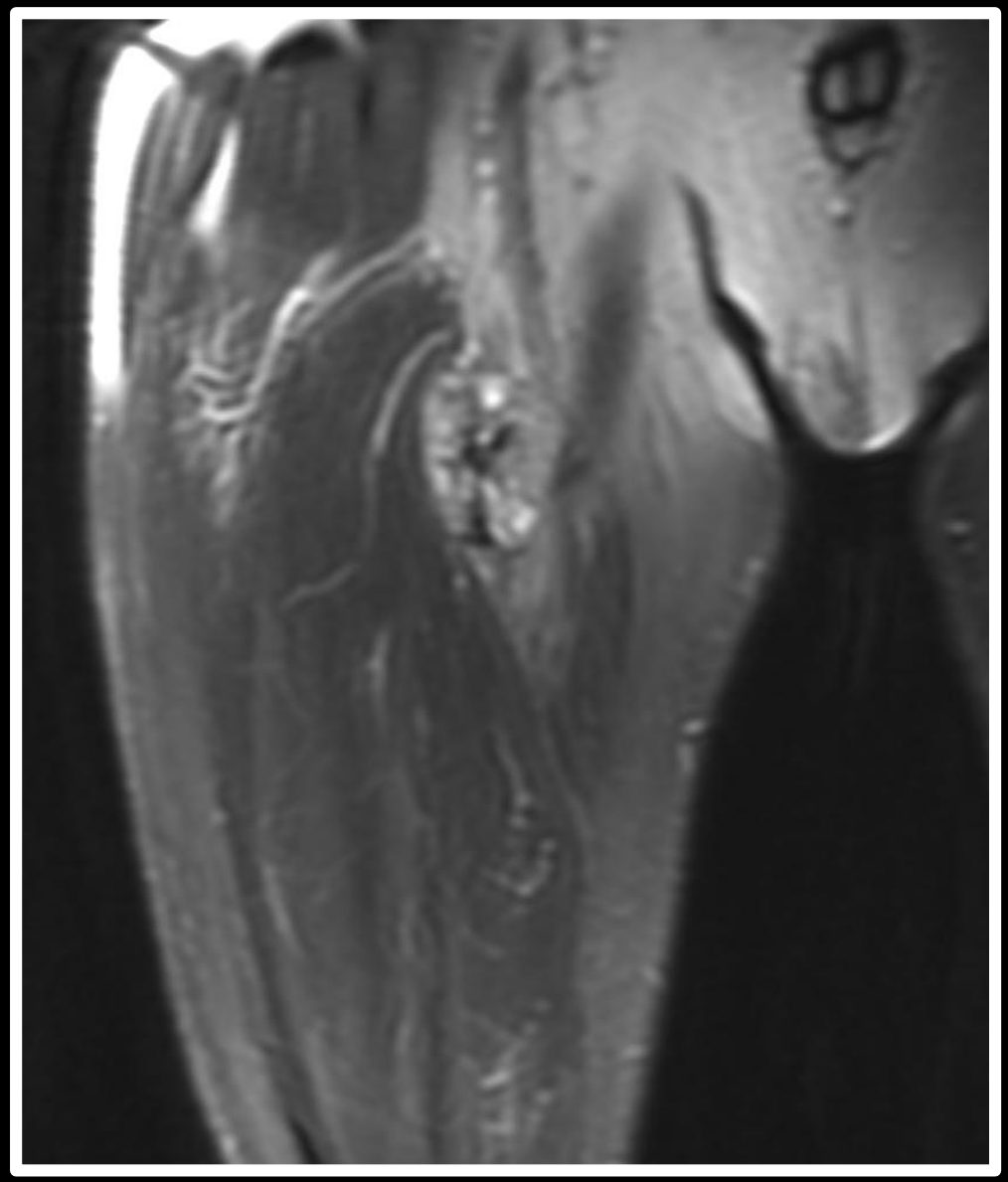
T1



STIR

T1 with contrast

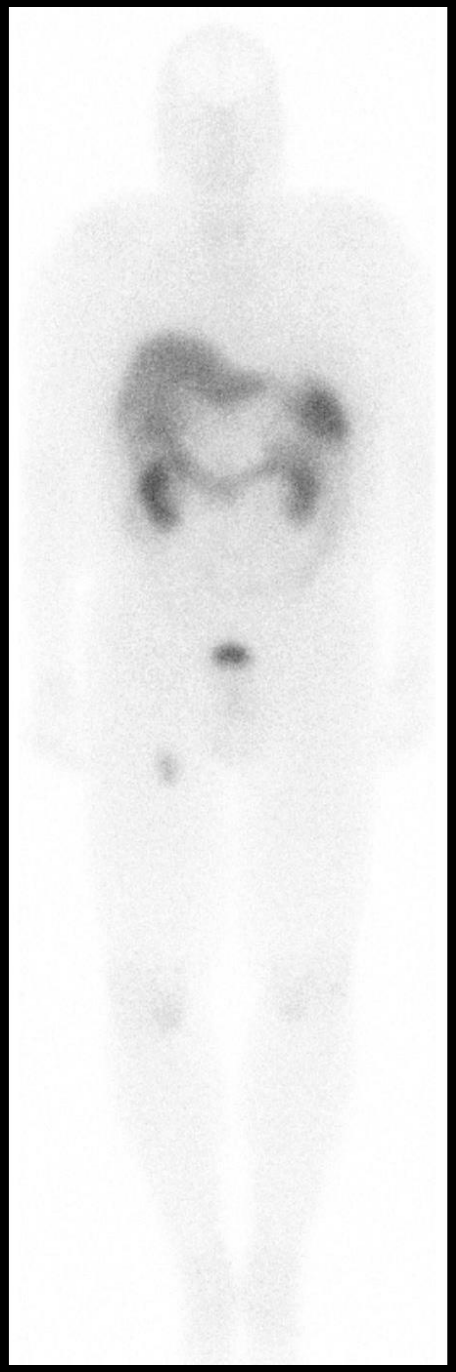
T1



STIR

Additional Data

- **Bone density evaluation → osteopenia**



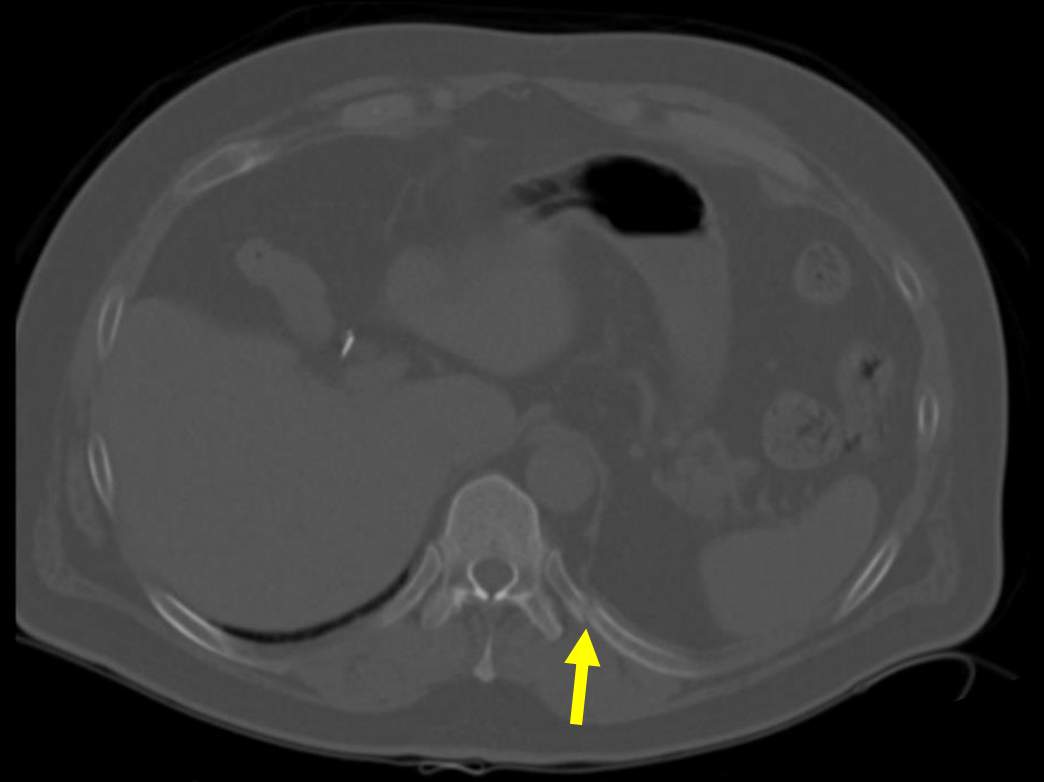
Clinical History

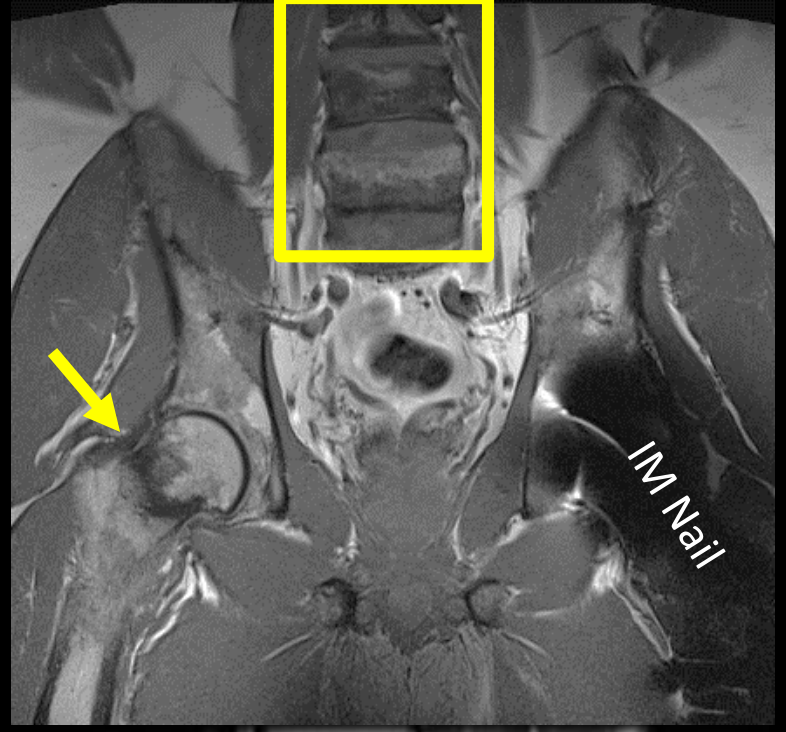
- Vitamin D deficiency/liver dz
- X-linked hypophosphatemia
- Drug toxicity
- Tumor-induced

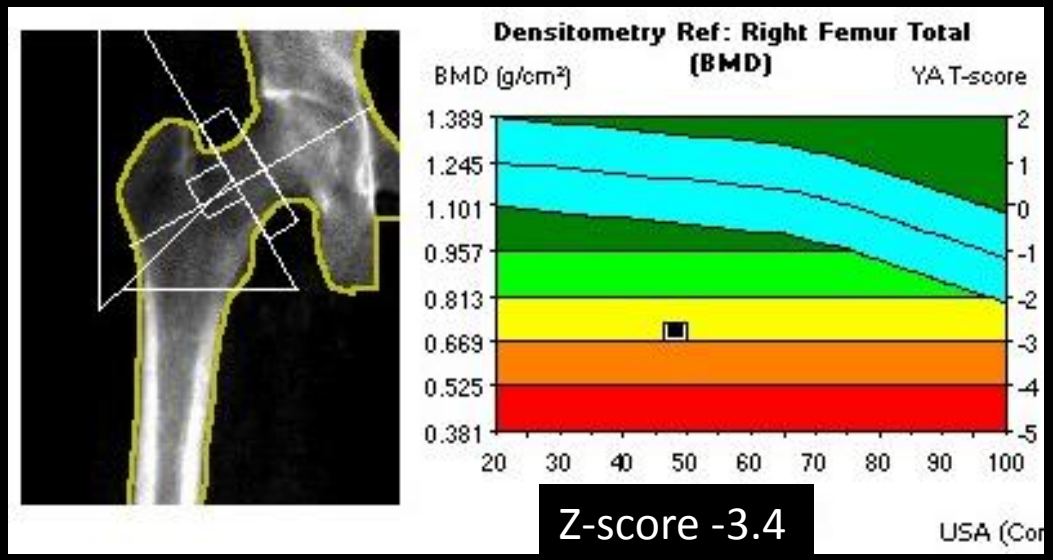
← OSTEOMALACIA

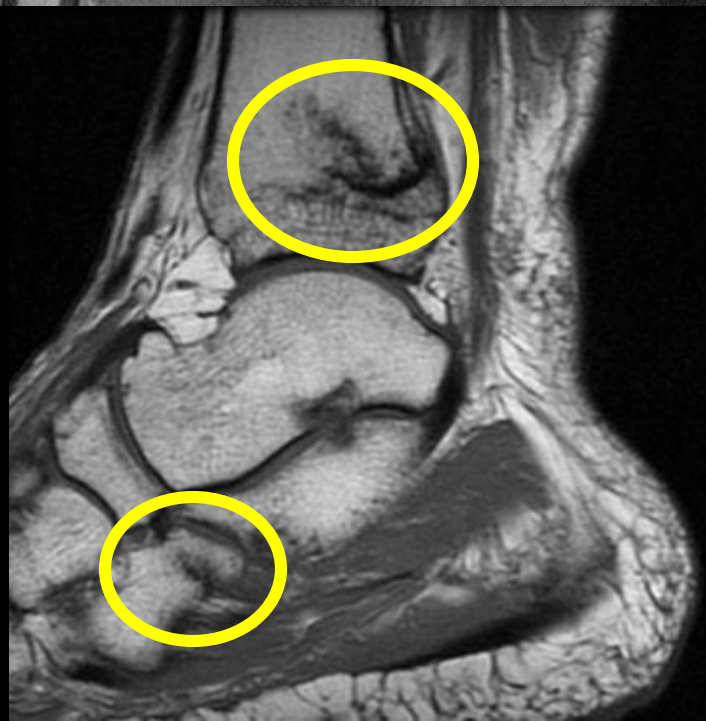
Laboratory

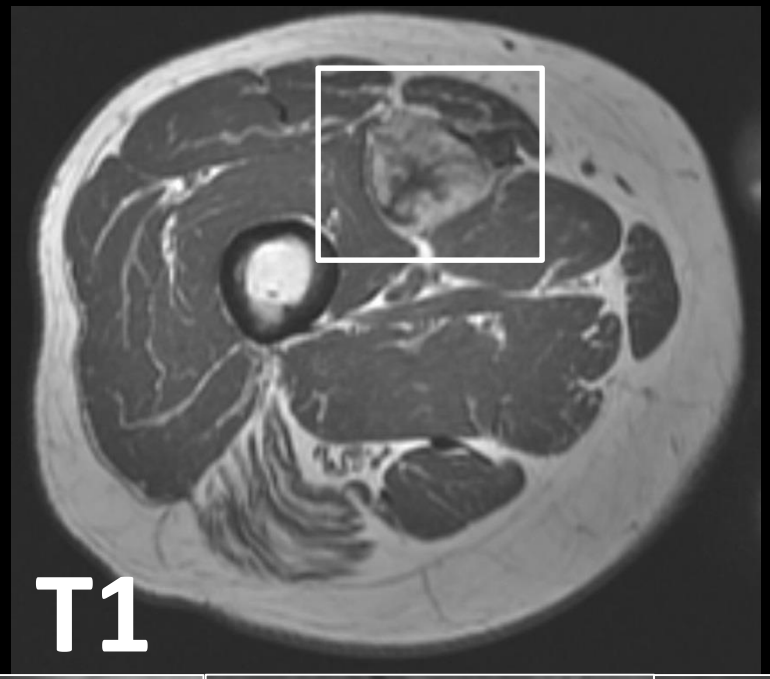
	Ca	PO^4	^{25}D	$^{1,25}D$
• Vitamin D deficiency/liver dz	↓	↓	↓	↓
• X-linked hypophosphatemia	±↓	↓	N	N
• Drug toxicity	N	N↑	N	N↓
• Tumor-induced	±↓	↓	N	↓



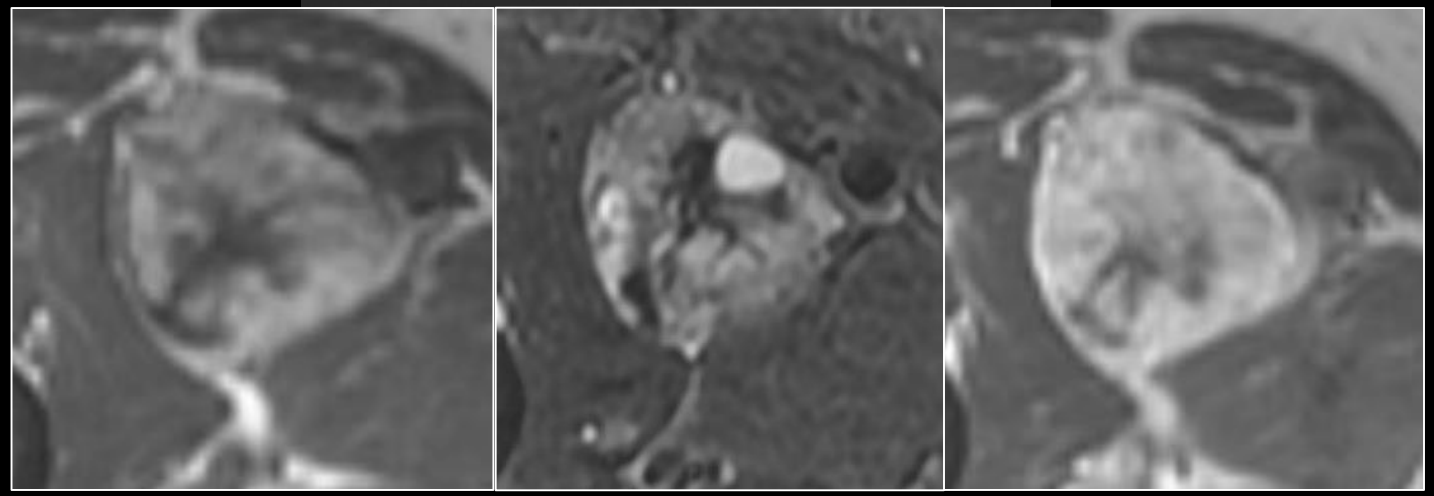

IM Nail


Densitometry Ref: Right Femur Total
(BMD)
BMD (g/cm²)
YA T-score
1.389
1.245
1.101
0.957
0.813
0.669
0.525
0.381
2
1
0
-1
-2
-3
-4
-5
20
30
40
50
60
70
80
90
100
Z-score -3.4
USA (Cor





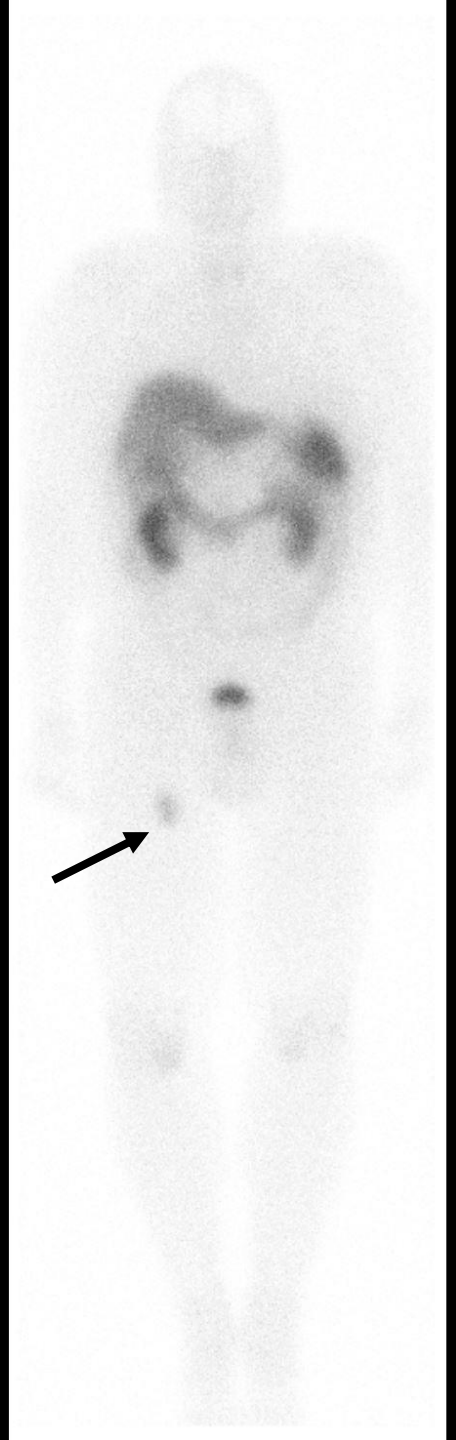
T1



T1 STIR T1+Gd

Imaging

- Size
- Location
- Density
- Enhancement
- *Tumor matrix
  - Amorphous
  - Punctate



Octreoscan
(Octreotide, ^{111}In-pentetreotide)

- <u>Tumors - high expression somatostatin receptors</u>
  - Neuroendocrine tumors
  - Adrenal medullary tumors
  - Merkel cell tumor of skin
  - Pituitary adenoma
  - Small-cell lung carcinoma
  - Phosphaturic mesenchymal tumors

2018 RSNA
Image Interpretation Session

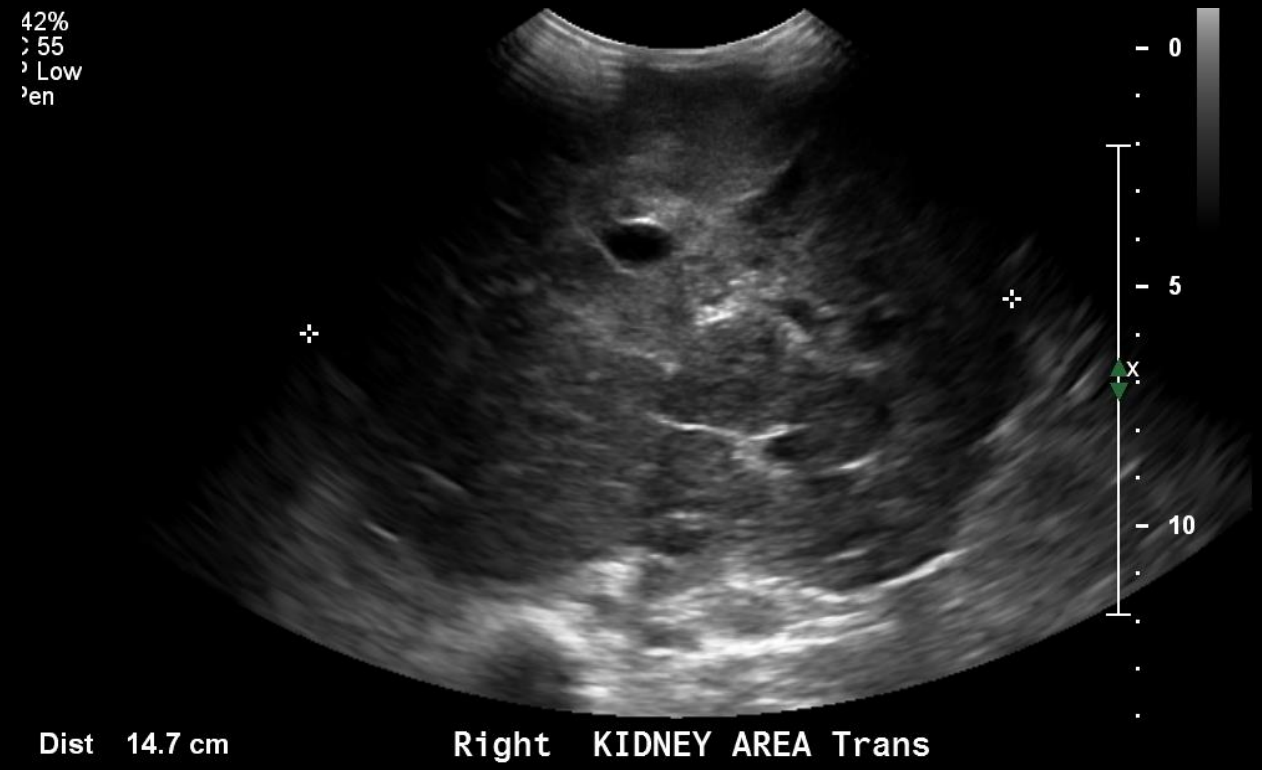
Peds

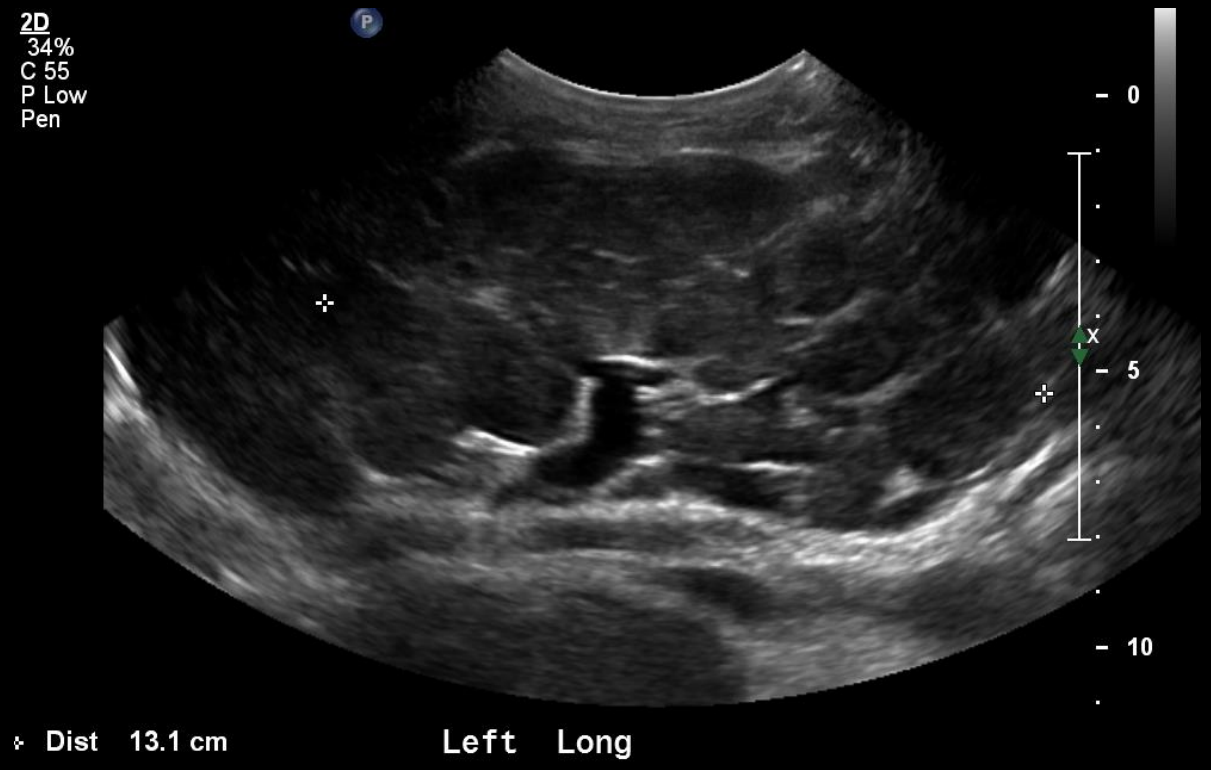
RSNA®

History

- 2 year old girl who originally presented at an outside practice
  - “renal abnormalities”
  - abdominal distension
- Followed by renal ultrasound

Renal Ultrasound at 2 Years of Age

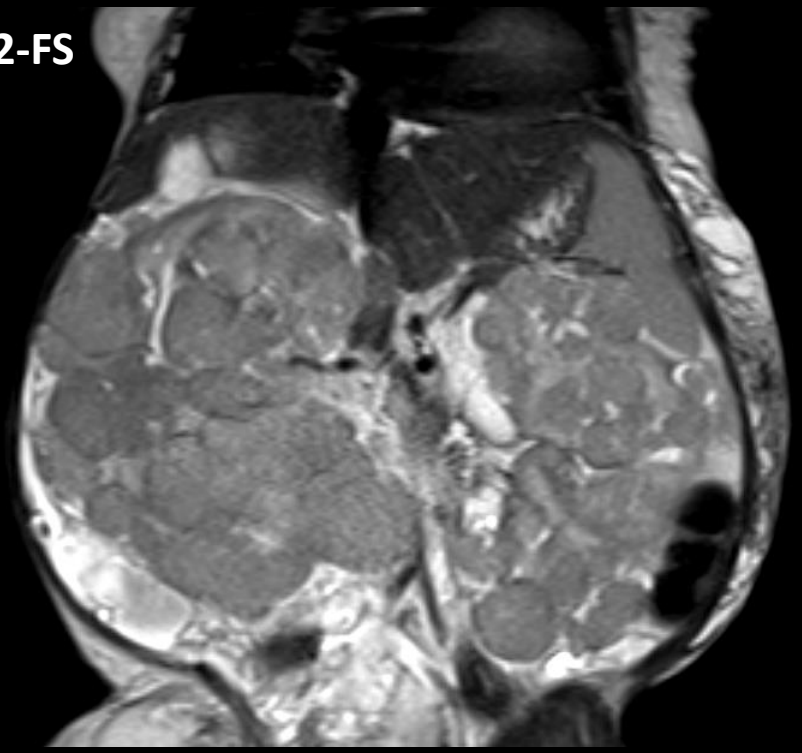


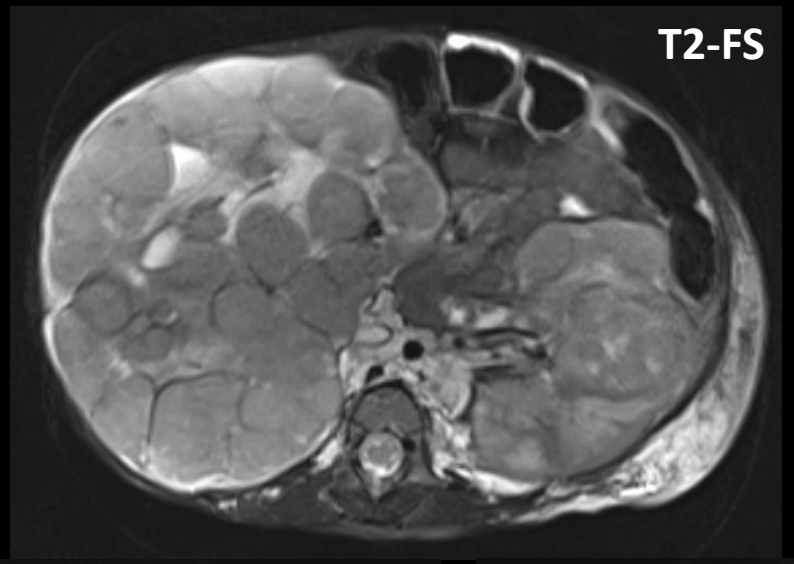


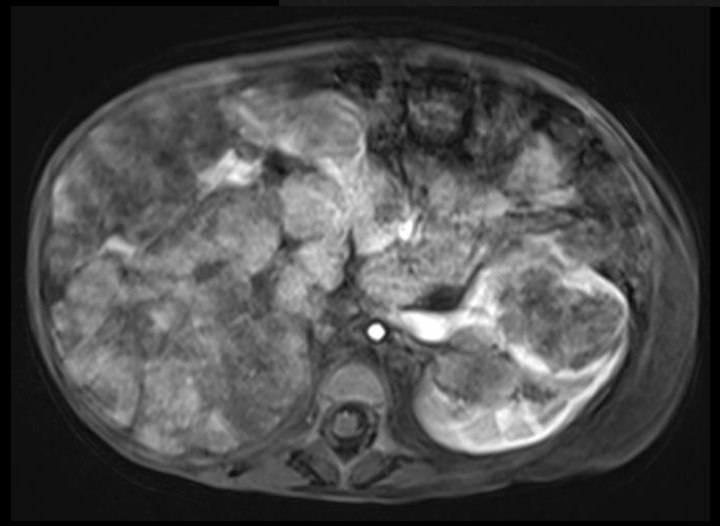
History

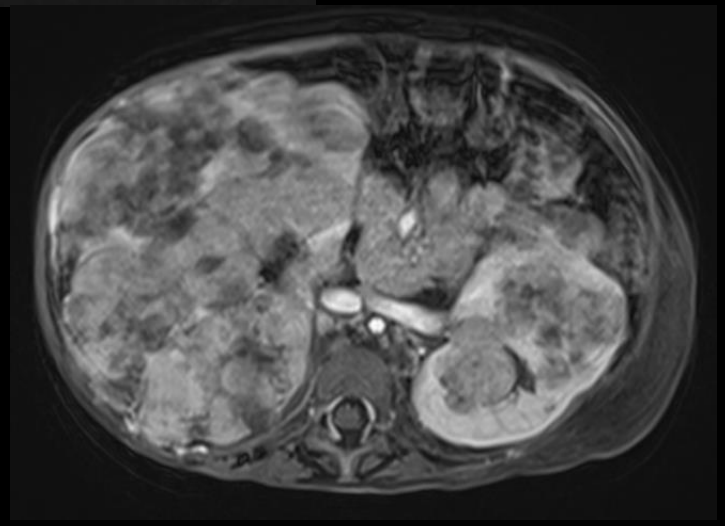
- 2 year old girl who originally presented at an outside practice
  - “renal abnormalities”
  - abdominal distension
- Followed by renal ultrasound
- At 26 months of age:
  - enlarged right kidney; mass suspected
  - MRI performed

MRI at 26 Months of Age



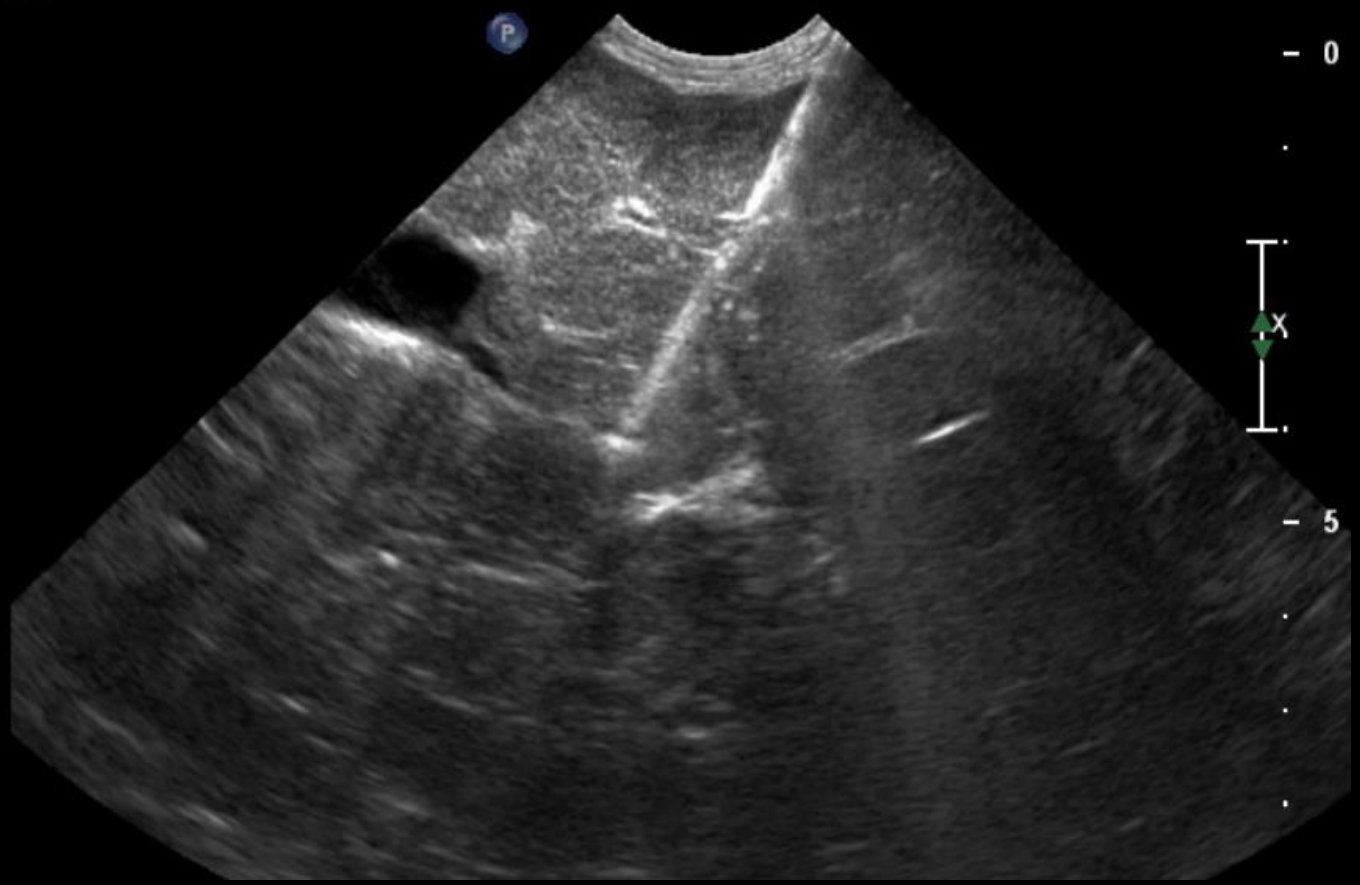






RSNA®

Subsequently, US-Guided Right Renal Biopsies: *eventual path diagnosis was "Wilms"*



Findings

- Young child with asymmetric nephromegaly and multiple solid masses replacing normal renal parenchyma with loss of cortico-medullary distinction

↓

- Nephroblastomatosis +/- Wilms tumor >>>>>>>>>> lymphoma, metastases

- Very difficult to distinguish hyperplastic nephrogenic rests from Wilms tumor on biopsy

- It can’t be that straightforward, can it?

Additional Findings

- Fluid-filled locules within left abdominal wall, para-aortic/para-renal retroperitoneum, and right pelvis; ? thoracic and right hip lipomatosis; otherwise, decreased adipose tissue

↓

- Overgrowth syndrome with veno-lymphatic vascular malformations

- Isolated hemihypertrophy, Beckwith-Wiedemann, Perlman, Soto, and Simpson-Golabi-Behmel syndromes are associated with overgrowth, nephrogenic rests and Wilms tumor

- So, what could be the diagnosis in this case?

Deepest Gratitude

Neuro:
Michael Malinzak, MD

Breast:
Jay Baker, MD

Thoracic:
Page McAdams MD

CVI & Abd GU:
Daniele Marin, MD

Abd GI:
Rendon Nelson, MD

MSK:
Lee Cothran, MD

Peds:
Gary Schooler, MD

RSNA

Thank You