Radiology/Pathology Conference
November 2009

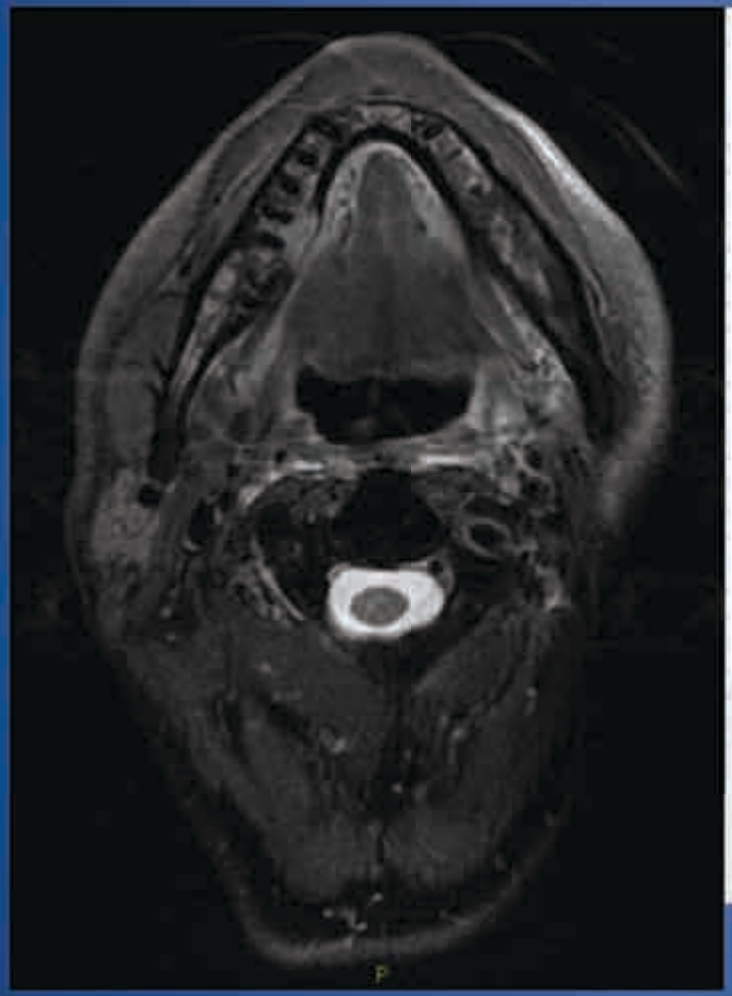
Neal Young MD

Sharlin JohnyKutty MD

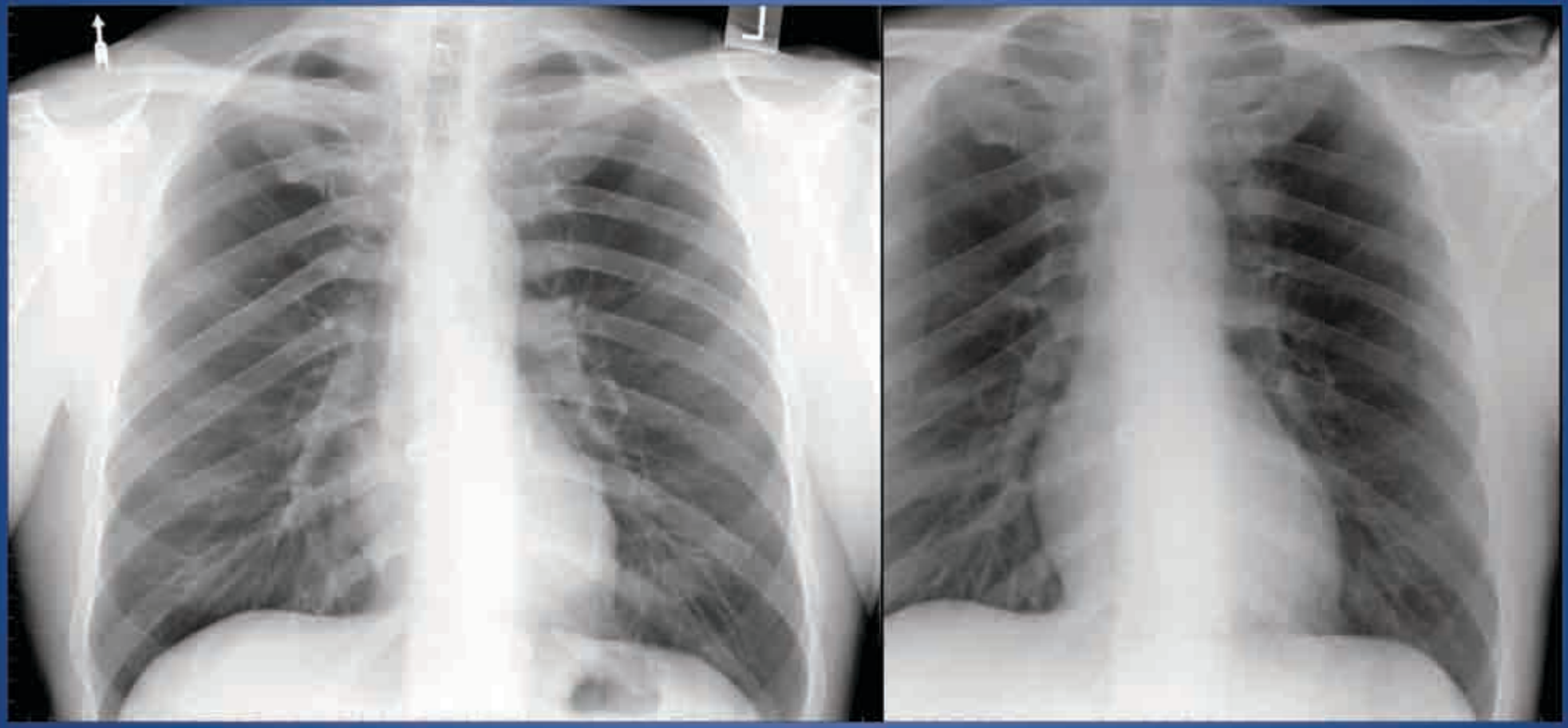
Case 1

- 43 Year Old Male
- History of Neck Cancer
- Asymptomatic
- Surveillance exam

Surveillance exam for 43 year old male with history of neck cancer.

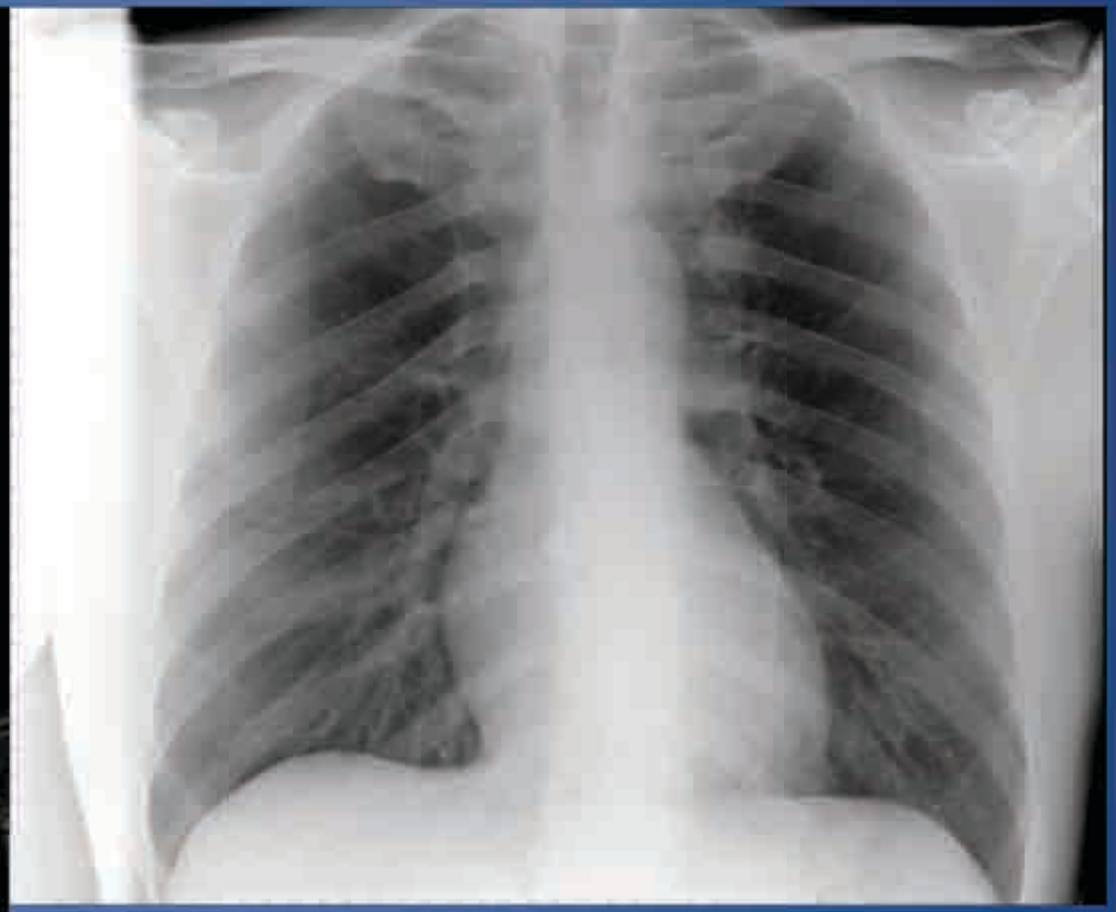


Surveillance exam for 43 year old male with history of neck cancer.

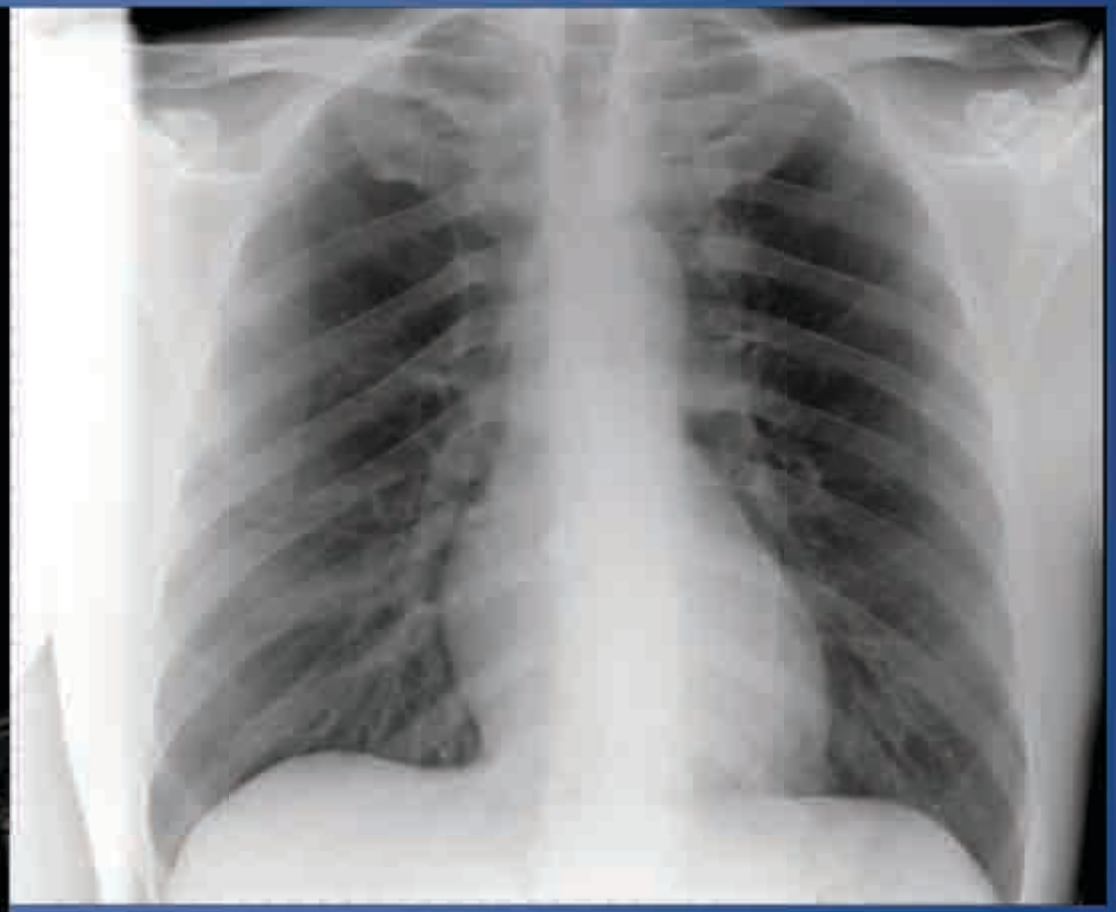


6 months prior

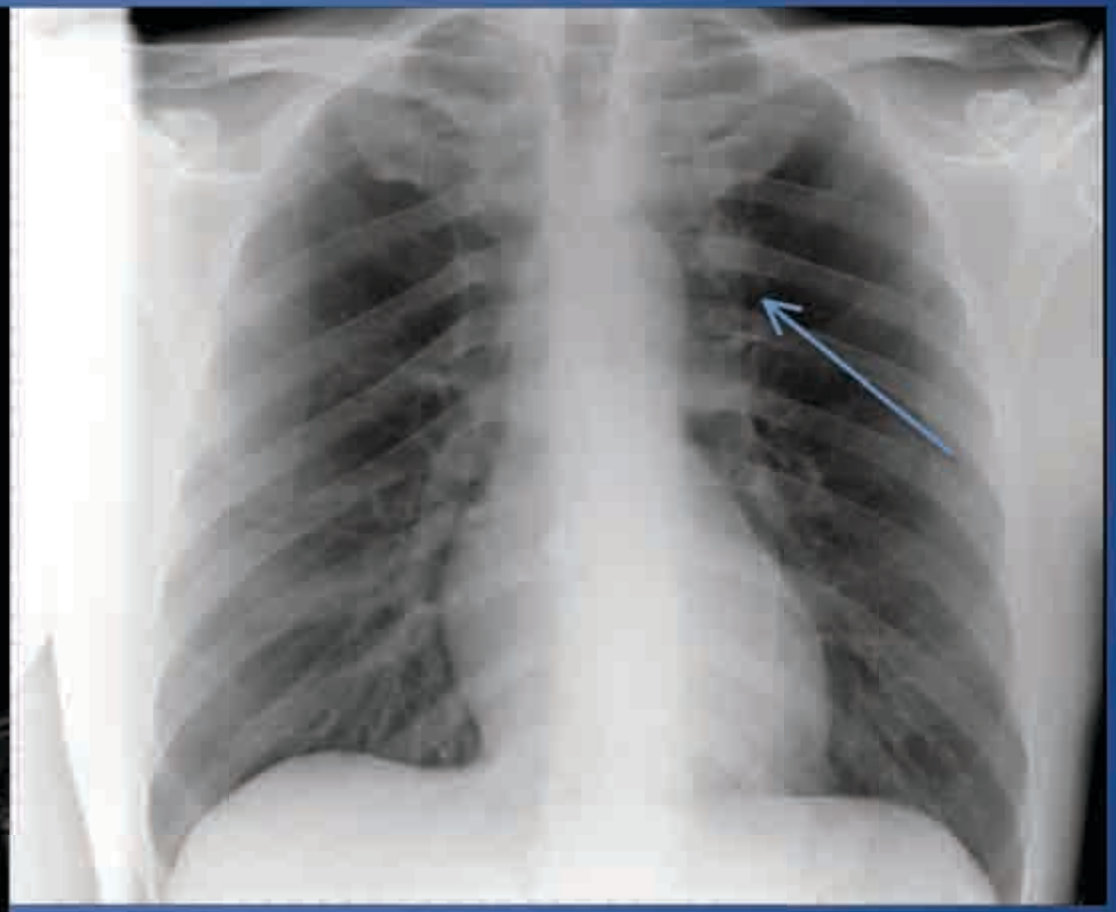
Surveillance exam for 43 year old male with history of neck cancer.



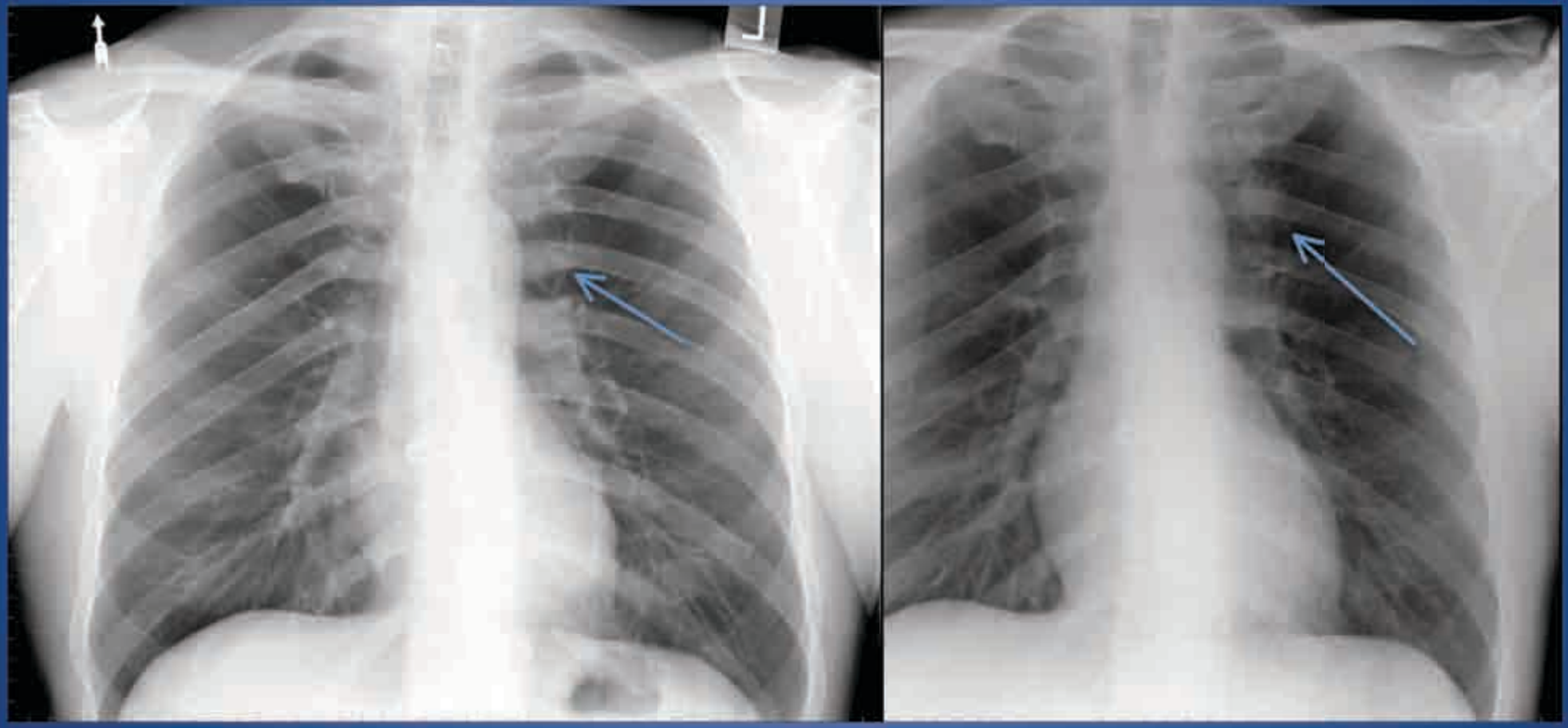
Surveillance exam for 43 year old male with history of neck cancer.



Surveillance exam for 43 year old male with history of neck cancer.

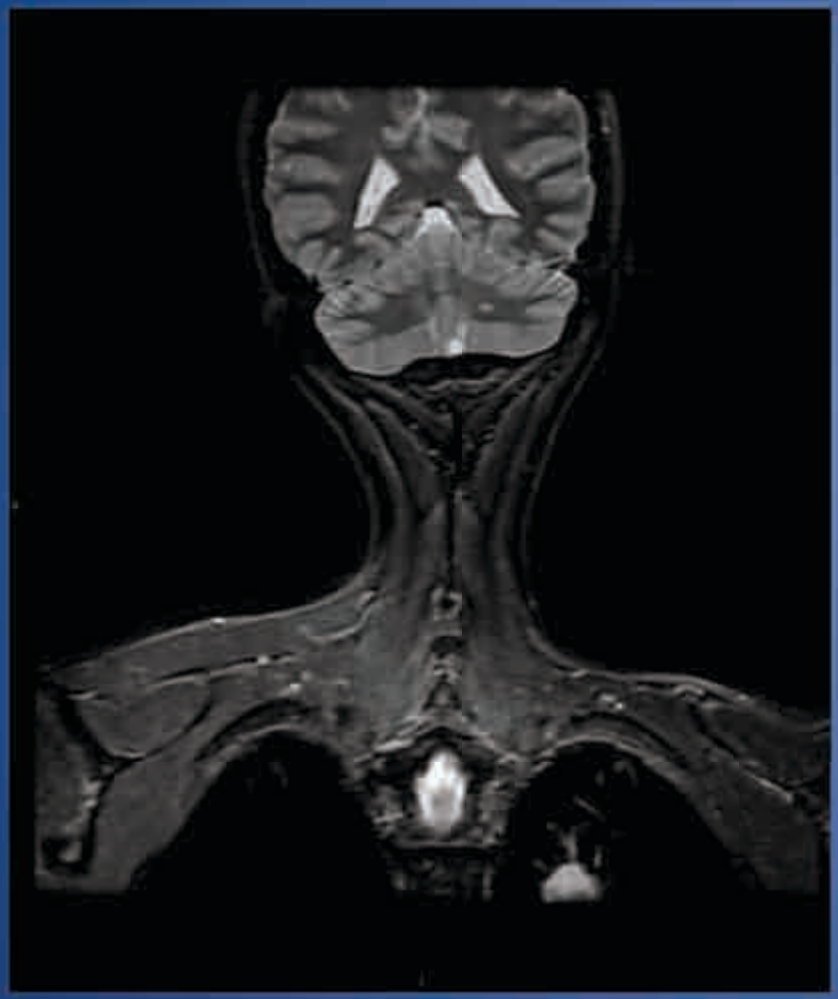


Surveillance exam for 43 year old male with history of neck cancer.

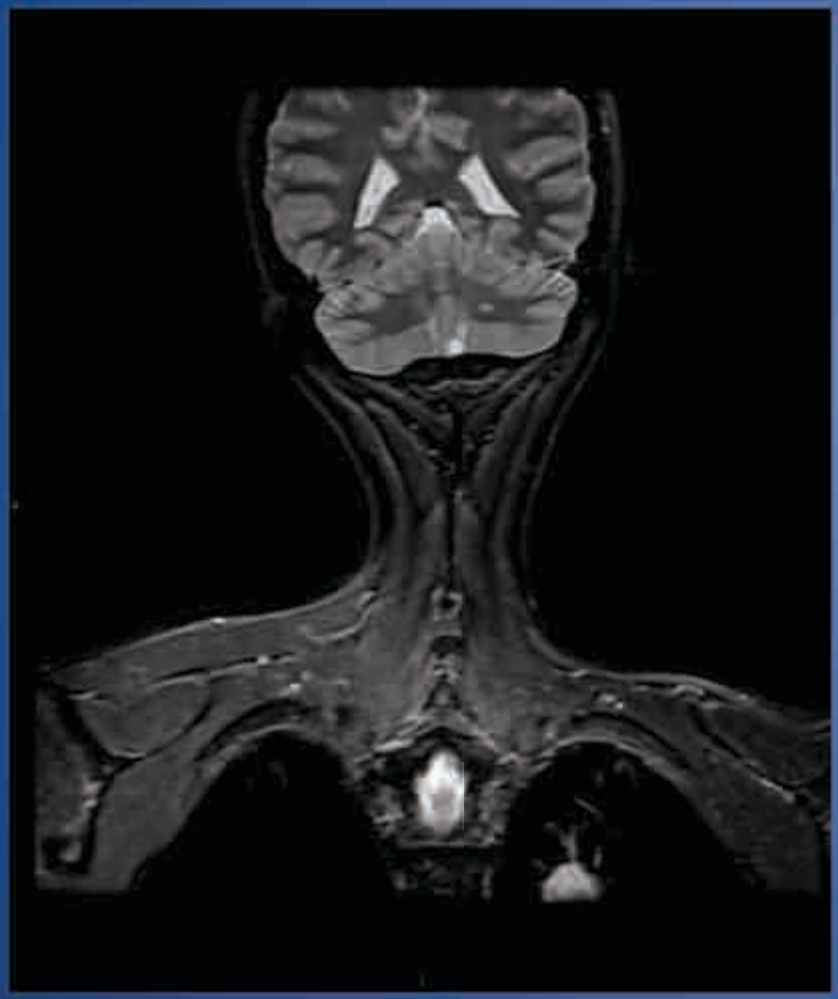


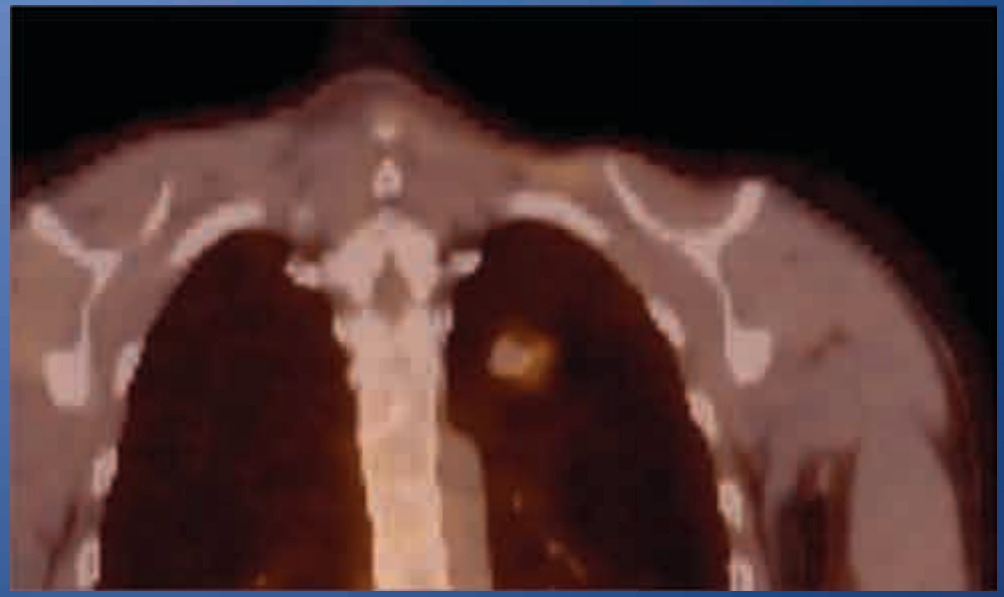
6 months prior

Surveillance exam for 43 year old male with history of neck cancer.



Surveillance exam for 43 year old male with history of neck cancer.





A common radiographic problem is the evaluation of the patient with a solitary pulmonary nodule (SPN).

90% of SPN's are due to 5 causes:

- Lung cancer
- Granuloma
- Solitary metastasis
- Hamartoma
- Carcinoid tumors

Solitary Pulmonary Nodule Morphology

Benign characteristics

Well-circumscribed with smooth borders

Fat or water density

Calcification: Diffuse, "Bullseye", "Popcorn", Target

Cavitation: Wall thickness < 5 mm

Minimal Enhancement

Smaller

Malignant characteristics

Irregular, lobulated, ill-defined with **spiculated** borders

Soft tissue density

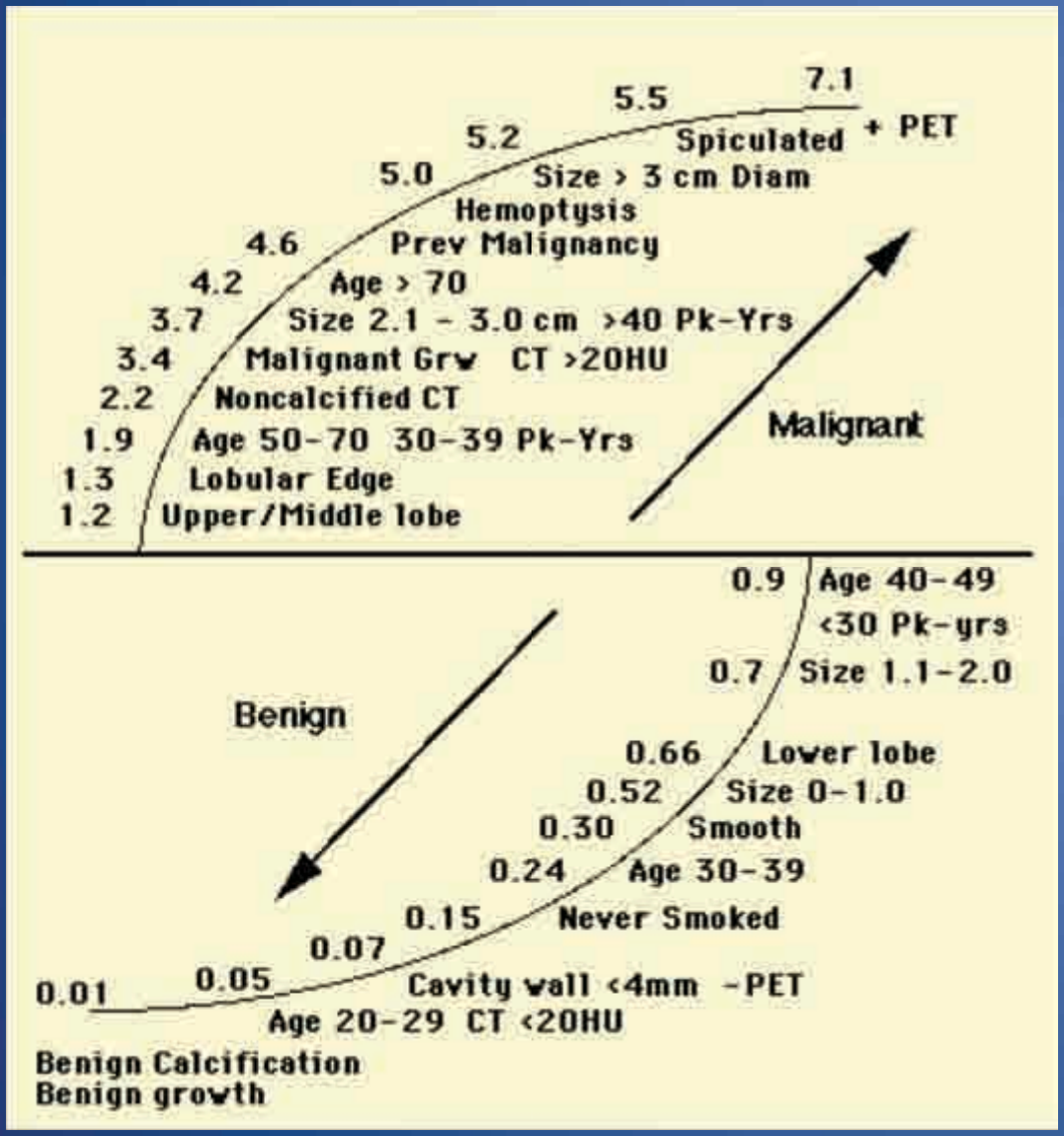
Calcification: Peripheral and stippled

Cavitation: Wall thickness < 15 mm

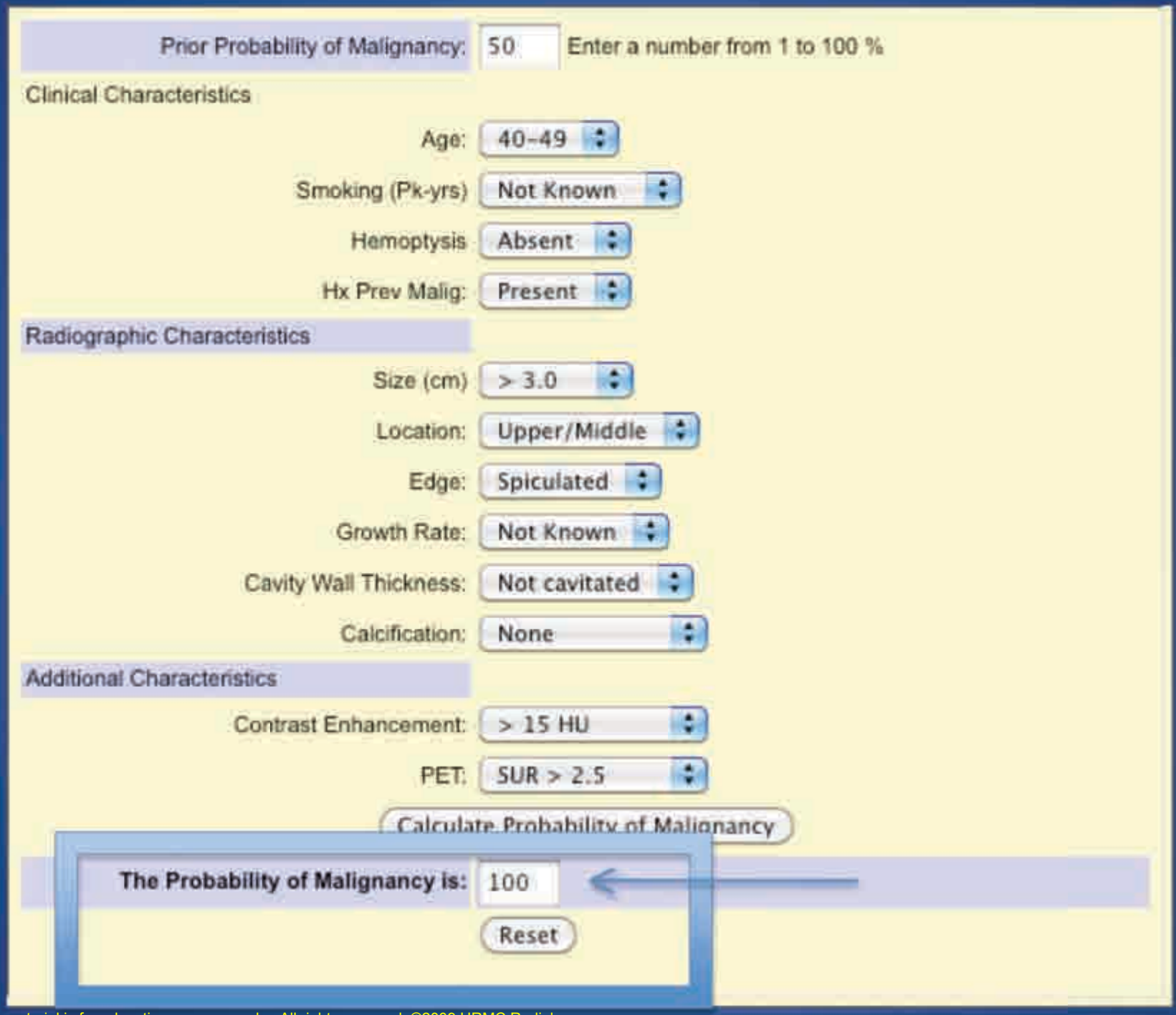
More prominent enhancement

Increased FDG activity

Solitary Pulmonary Nodule Morphology



Likelihood Ratios	
20-29	0.05
30-39	0.24
40-49	0.94
50-59	1.90
60-69	2.64
Nonsmoker	0.15
< 30 pk-yrs	0.74
30-39 pk-yrs	2
>40 pk-yrs	3.7
Hemoptysis, absent	1
Hemoptysis, present	5.08
No prev malig	1
Prev Malig	4.95
0-1 cm	0.52
1.1 - 2.0	0.74
2.1 - 3.0	3.67
> 3.0 cm	5.23
upper/middle	1.22
Lower	0.66
Smooth	0.3
Lobulated	0.74
Spiculated	5.54
Growth, not known	1
Benign growth rate	0.01
Malignant growth rate	3.4
Not cavitated	1
< 4 mm	0.07
5 - 15 mm	0.72
> 16	38
Not calcified	2.2
Benign calcification	0.01
Enhancement < 15 HU	0.04
Enhancement > 15 HU	2.32
SUR < 2.5	0.06
SUR > 2.5	7.1



Primary Lung vs. Metastasis?

Primary Lung vs. Metastasis?

Extrapulmonary malignancy	# of patients	% with metastasis	% with lung cancer	% with benign
Head & Neck squamous cell	33	9	76	15
Lymphoma or leukemia	14	0	57	43
Carcinoma: urinary bladder, breast, cervix, bile ducts, esophagus, ovary, prostate, stomach	45	18	58	24
Carcinoma: salivary gland, adrenal, colon, parotid, kidney, thyroid, thymus, uterus	31	52	42	6
Melanoma, sarcoma, testis	38	60	24	16

adapted from Quint et al

Primary Lung vs. Metastasis?

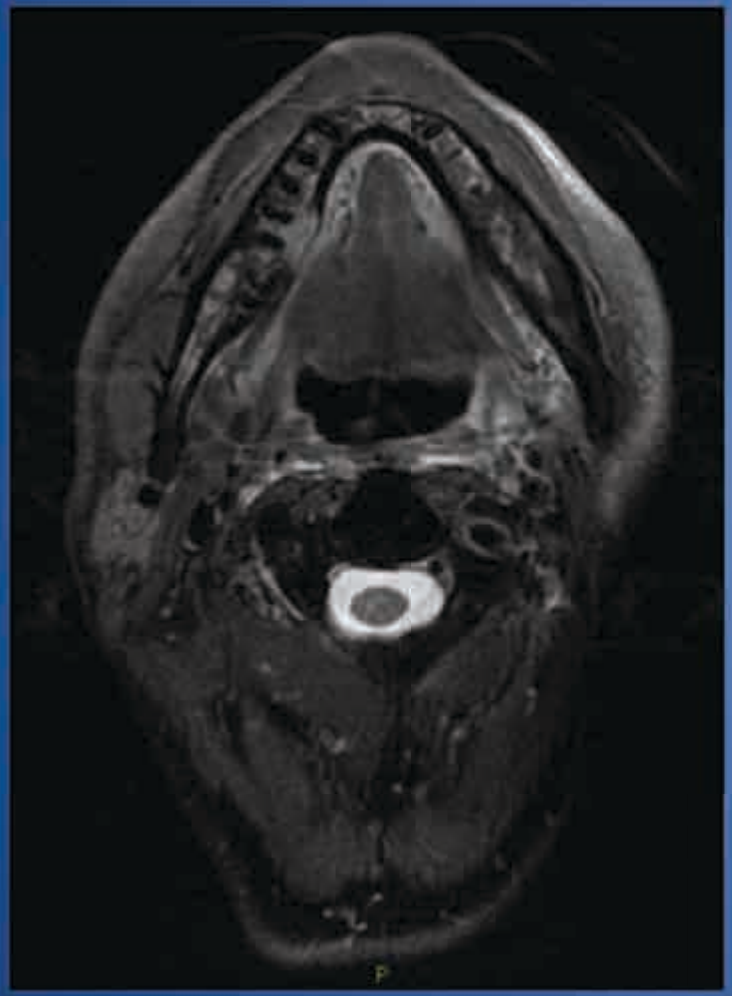
Extrapulmonary malignancy	# of patients	% with metastasis	% with lung cancer	% with benign
Head & Neck squamous cell	33	9	76	15

In patients with carcinoma of the [head and neck] were more likely to have primary bronchogenic carcinoma then metastasis (25:3)

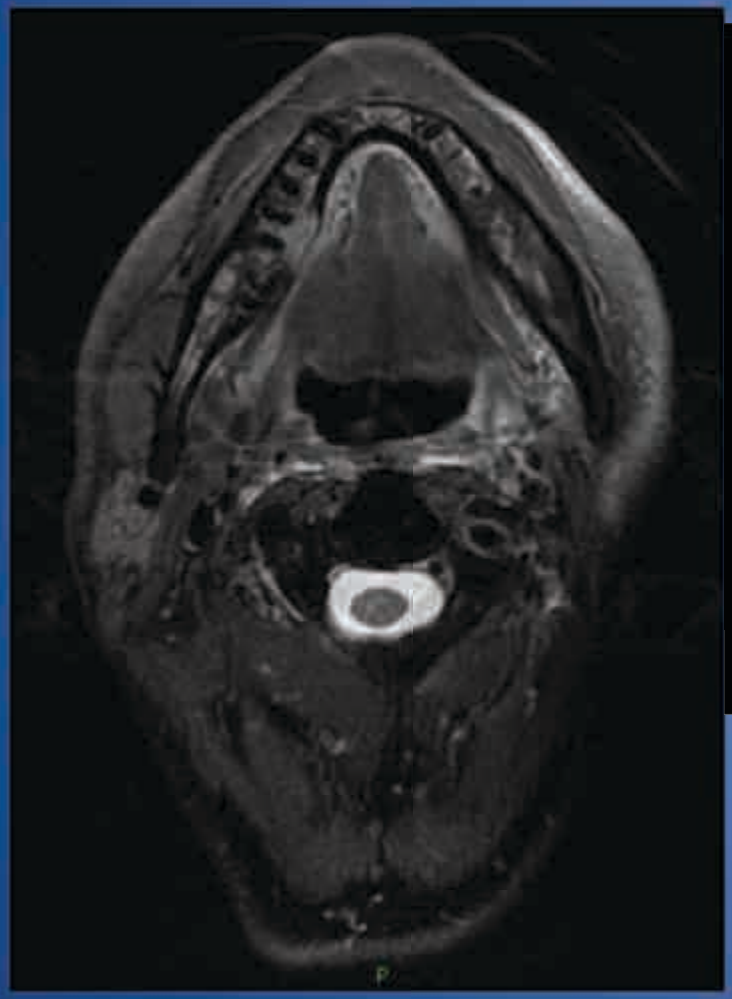
- Quint et al, Radiology 2000

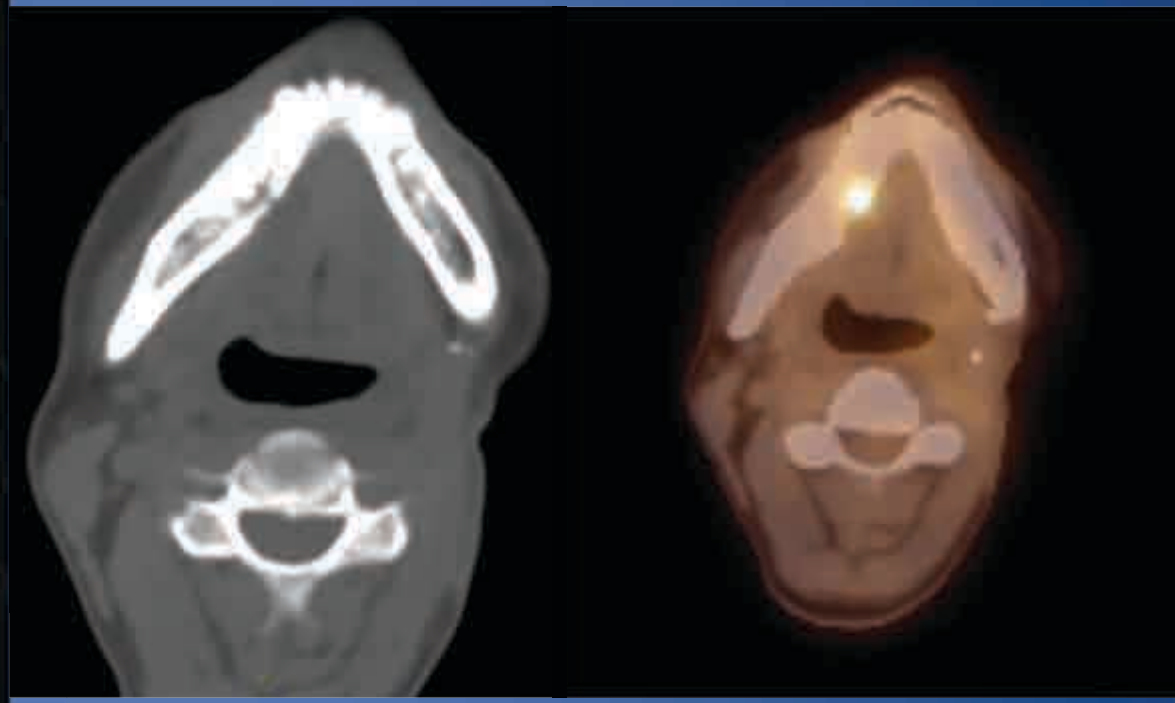
Data from 1940-1975 included 800 patients with SPN on CXR: 500 were primary lung cancer, 196 metastases, 11 benign

Surveillance exam for 43 year old male with history of neck cancer.

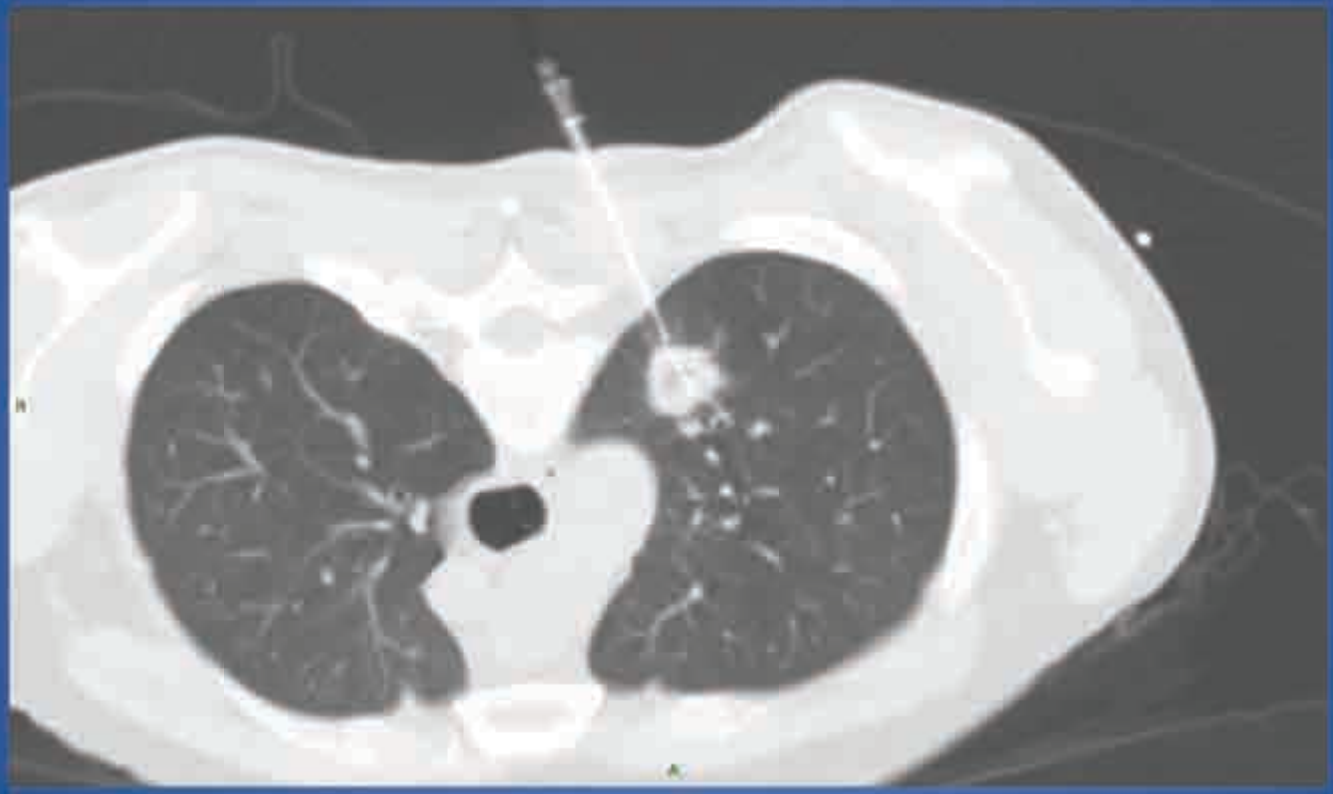


Surveillance exam for 43 year old male with history of neck cancer.



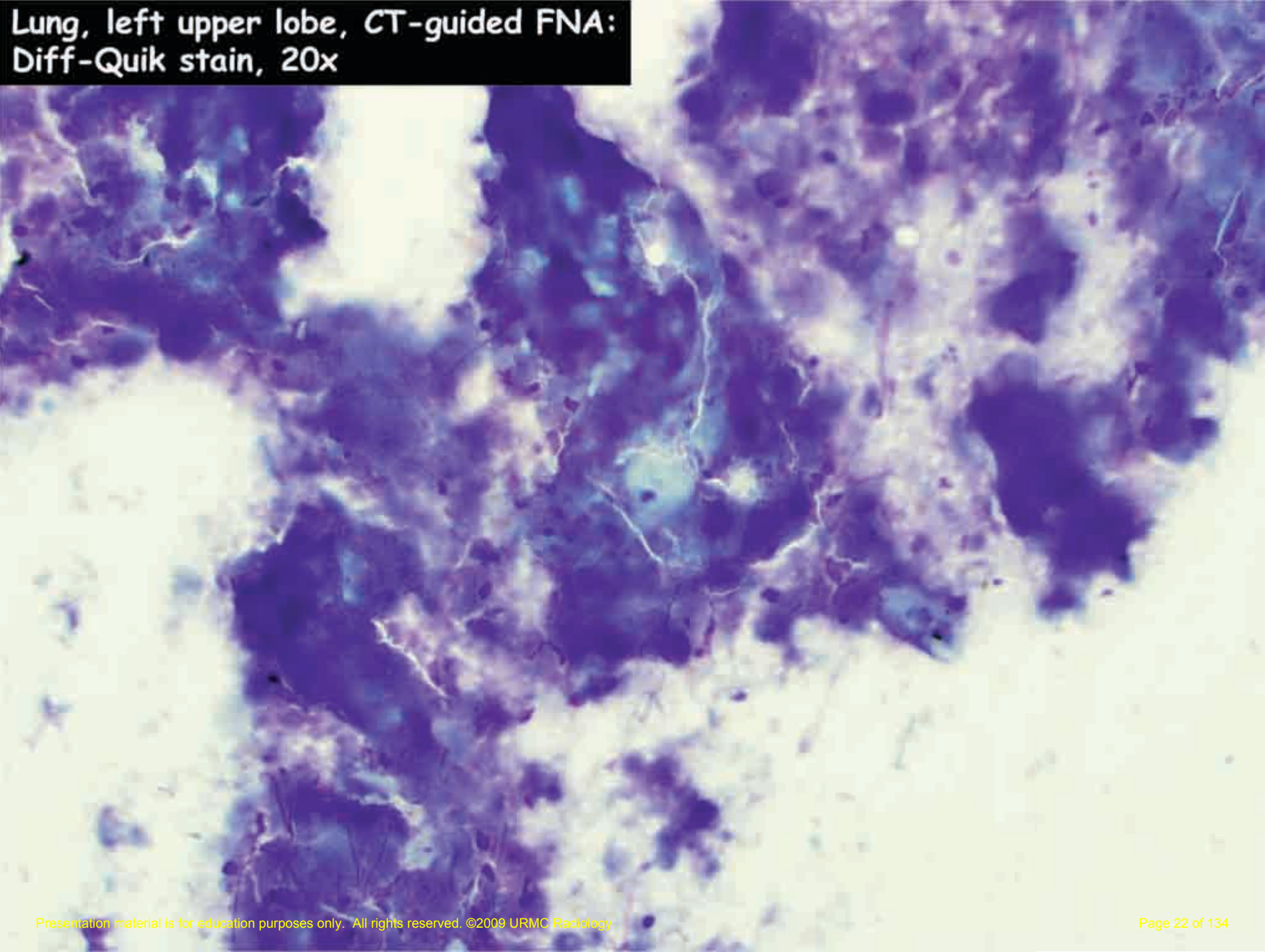


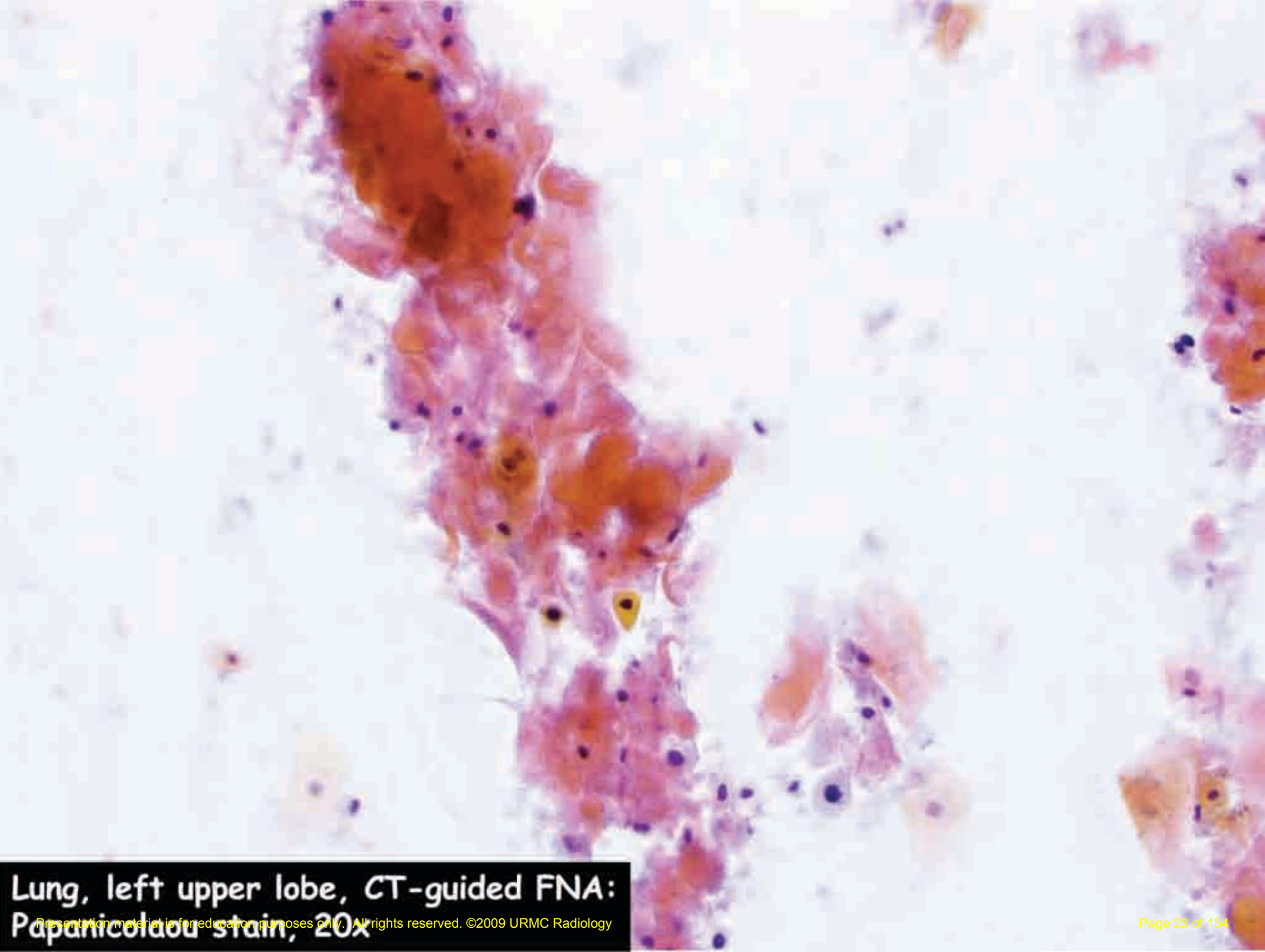
CT Guided Biopsy



Case 1

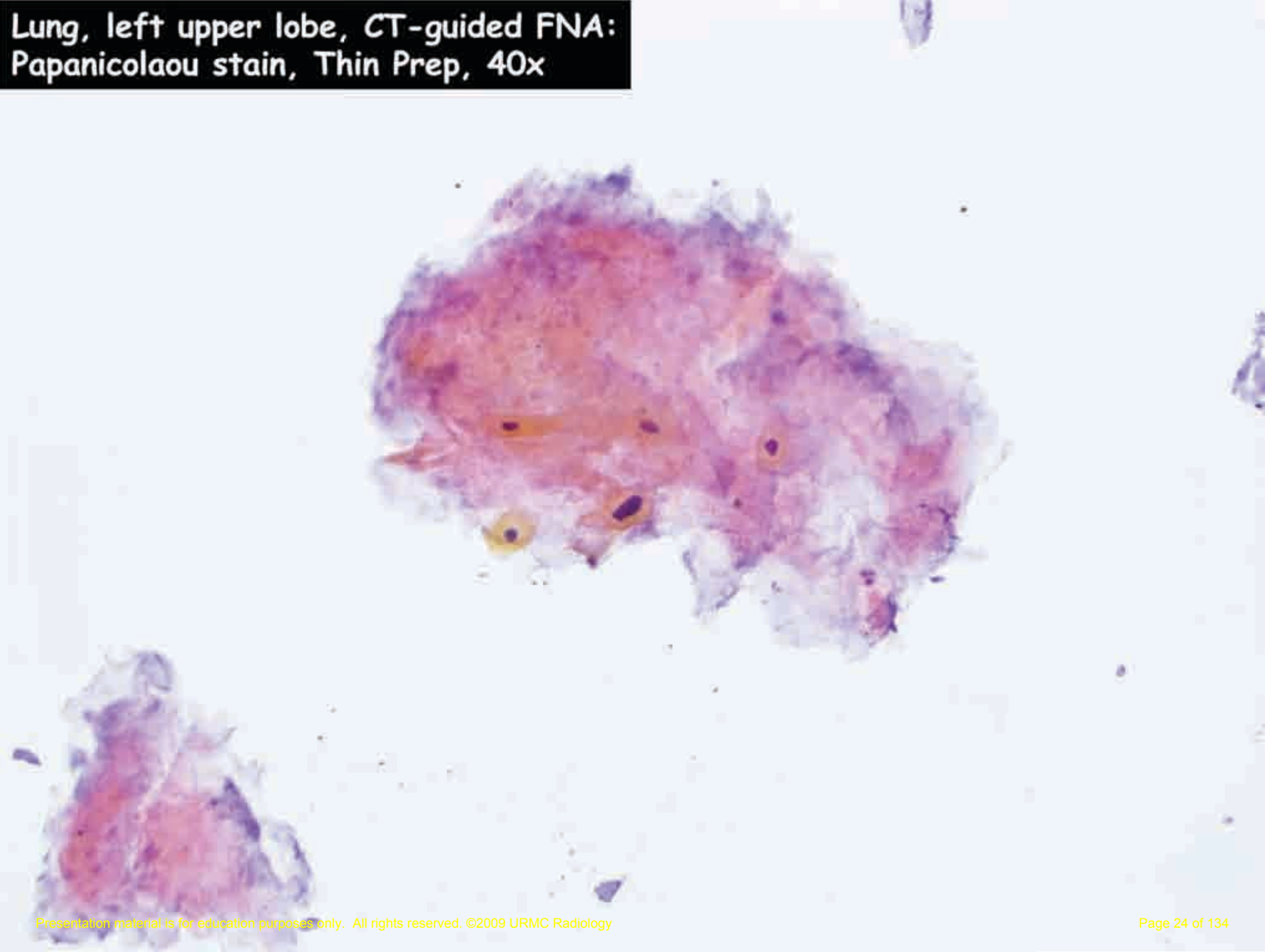
Lung, left upper lobe, CT-guided FNA:
Diff-Quik stain, 20x





Lung, left upper lobe, CT-guided FNA:
Papanicolaou stain, 20x

Lung, left upper lobe, CT-guided FNA:
Papanicolaou stain, Thin Prep, 40x



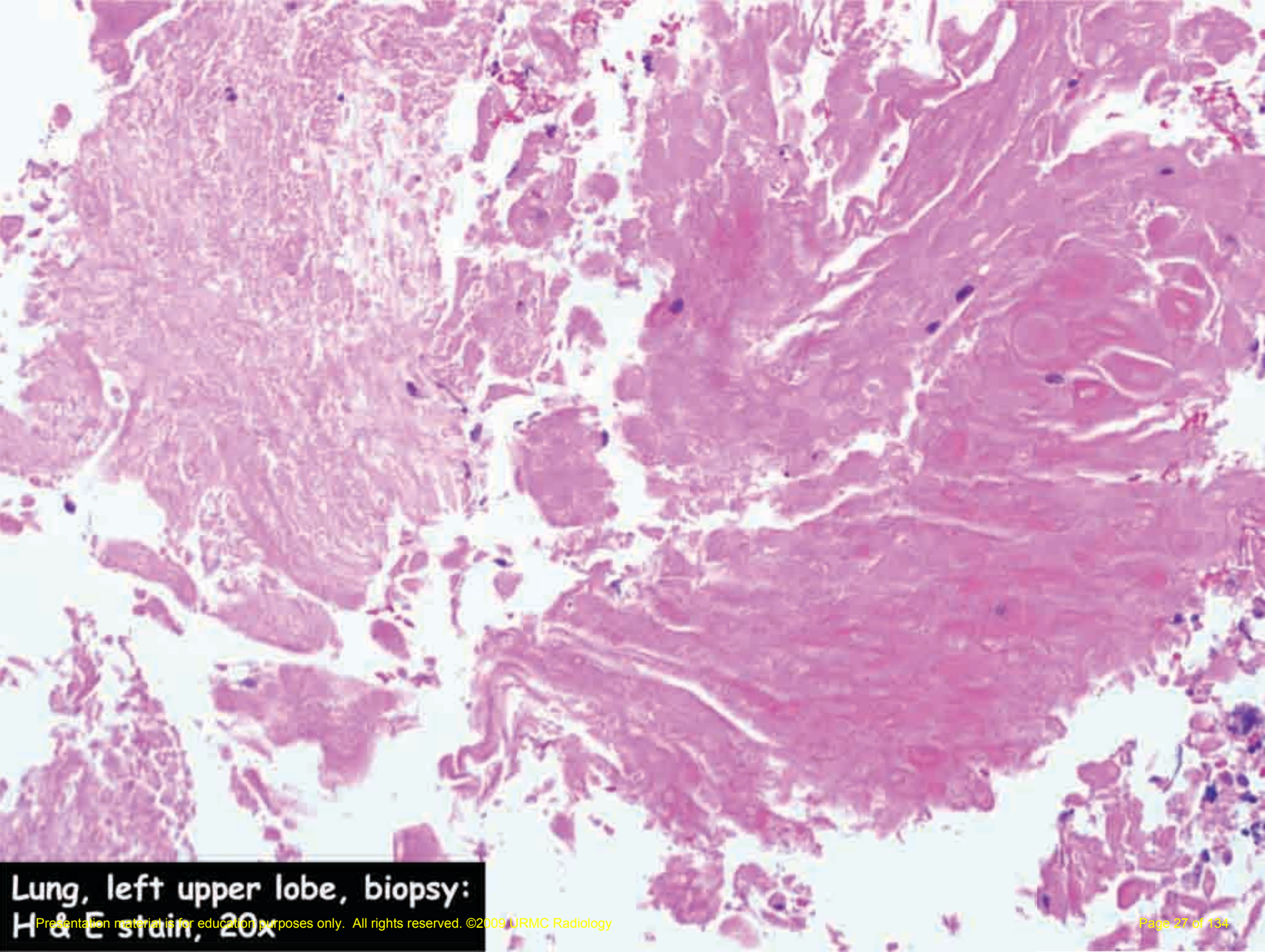
Lung, left upper lobe, CT-guided fine needle aspiration:

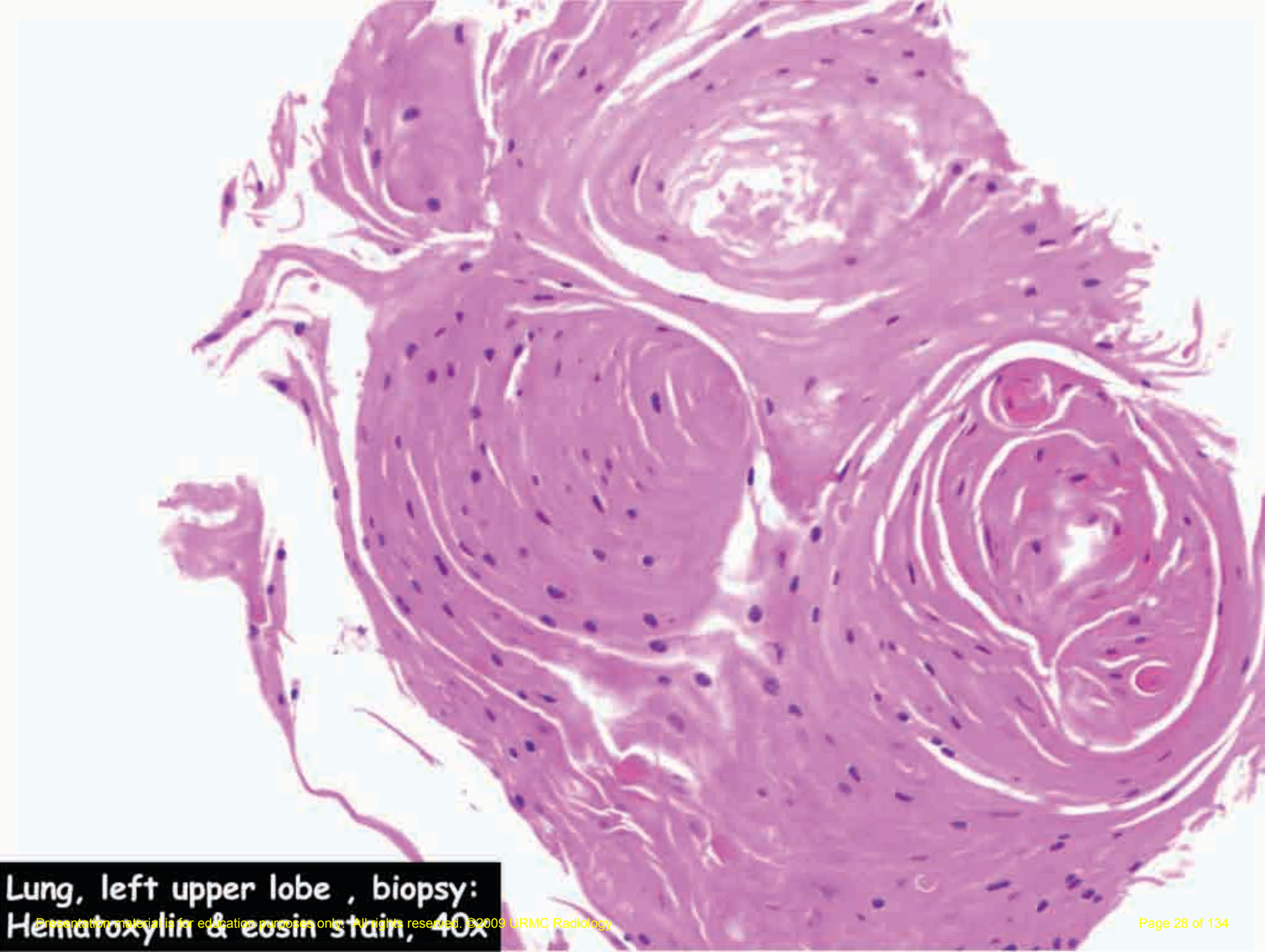
Malignant tumor cells present derived from squamous cell carcinoma.

Lung, left upper lobe, biopsy

Consistent with squamous cell carcinoma.

The tumor present in the outside slide consultation neck dissection is morphologically similar to that seen in the lung biopsy.



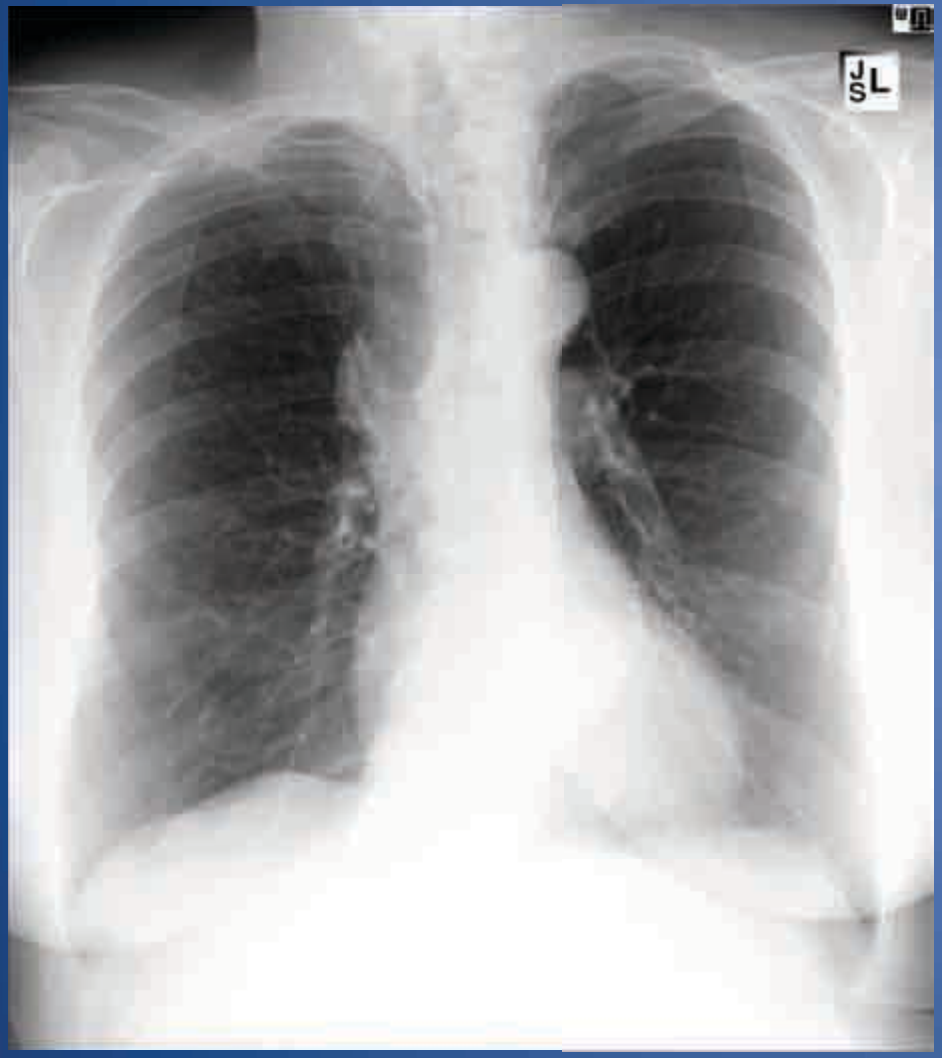


Lung, left upper lobe , biopsy:
Hematoxylin & eosin stain, 40x

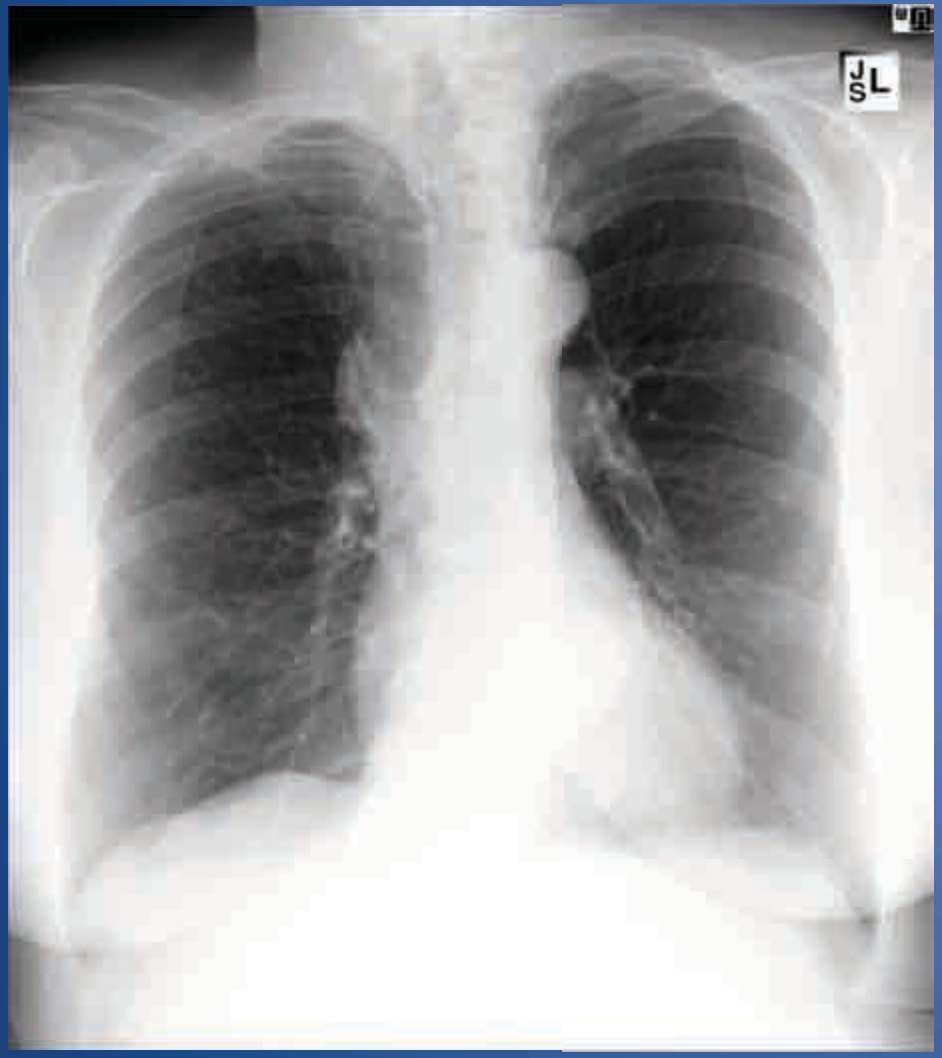
Case 2

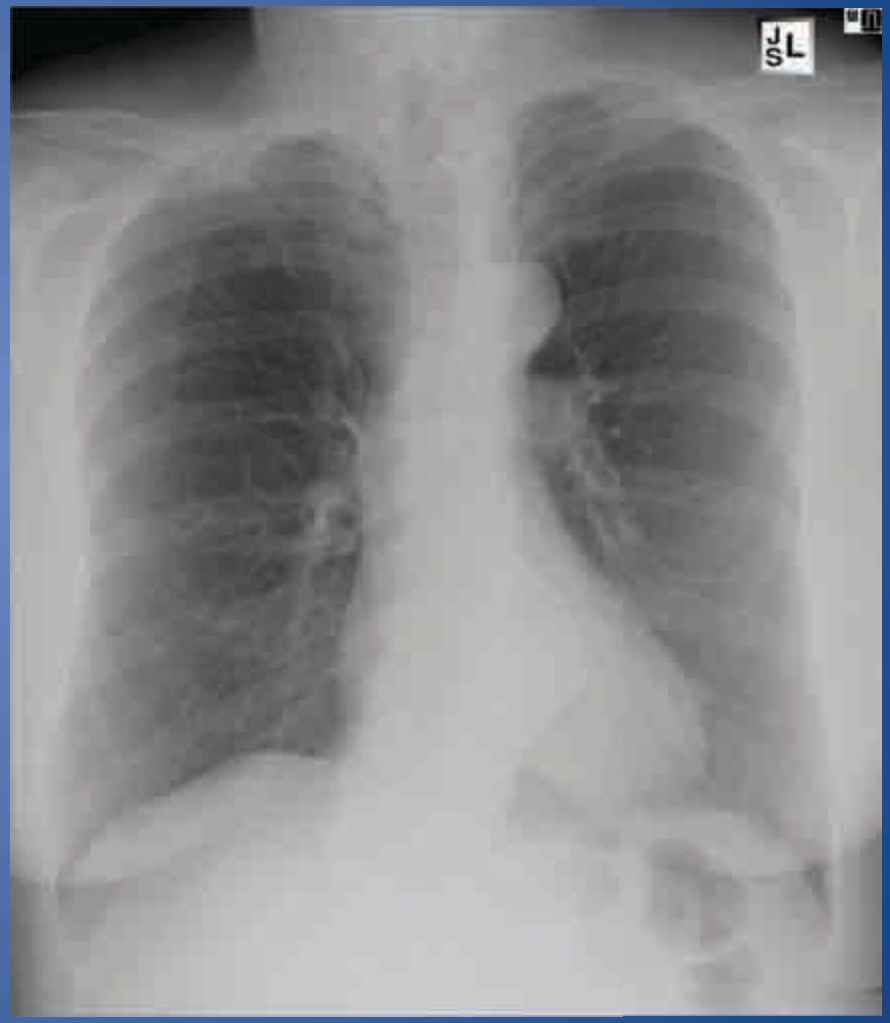
- 68 year old female
- Presents with cough
- PMH only significant for smoking and previous small bowel obstruction with ischemia.

68 Year Old female with cough



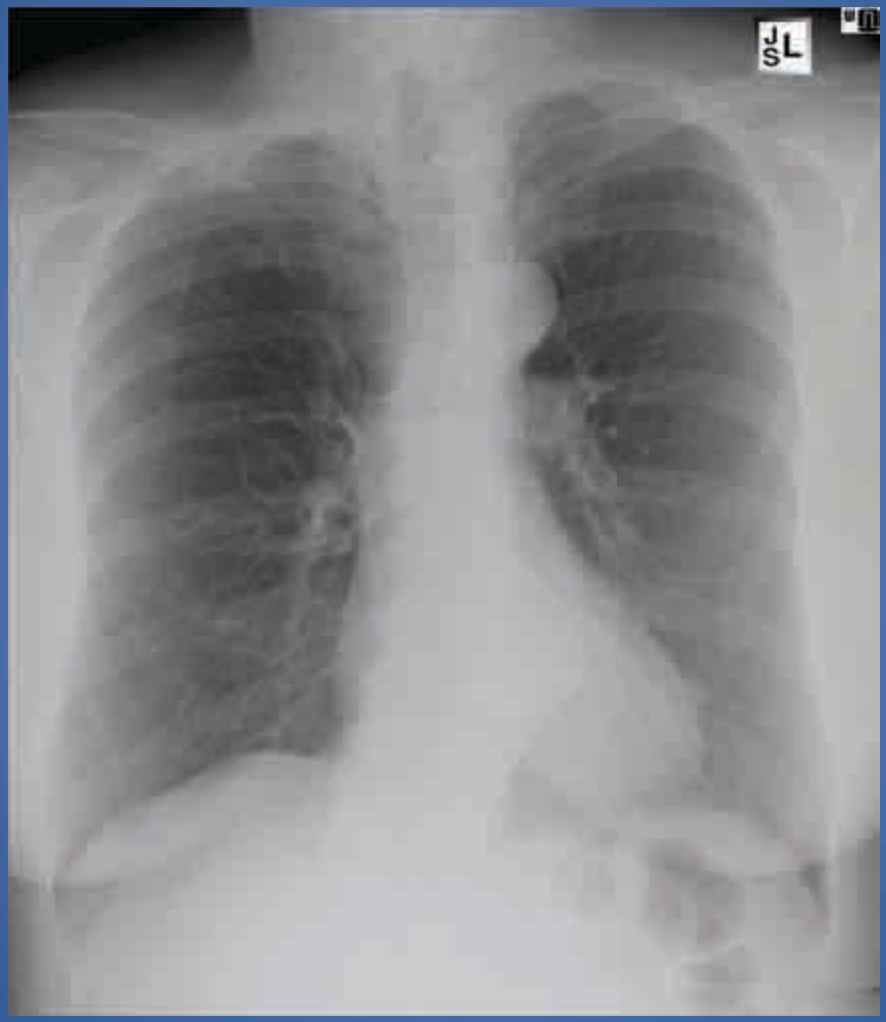
68 Year Old female with cough



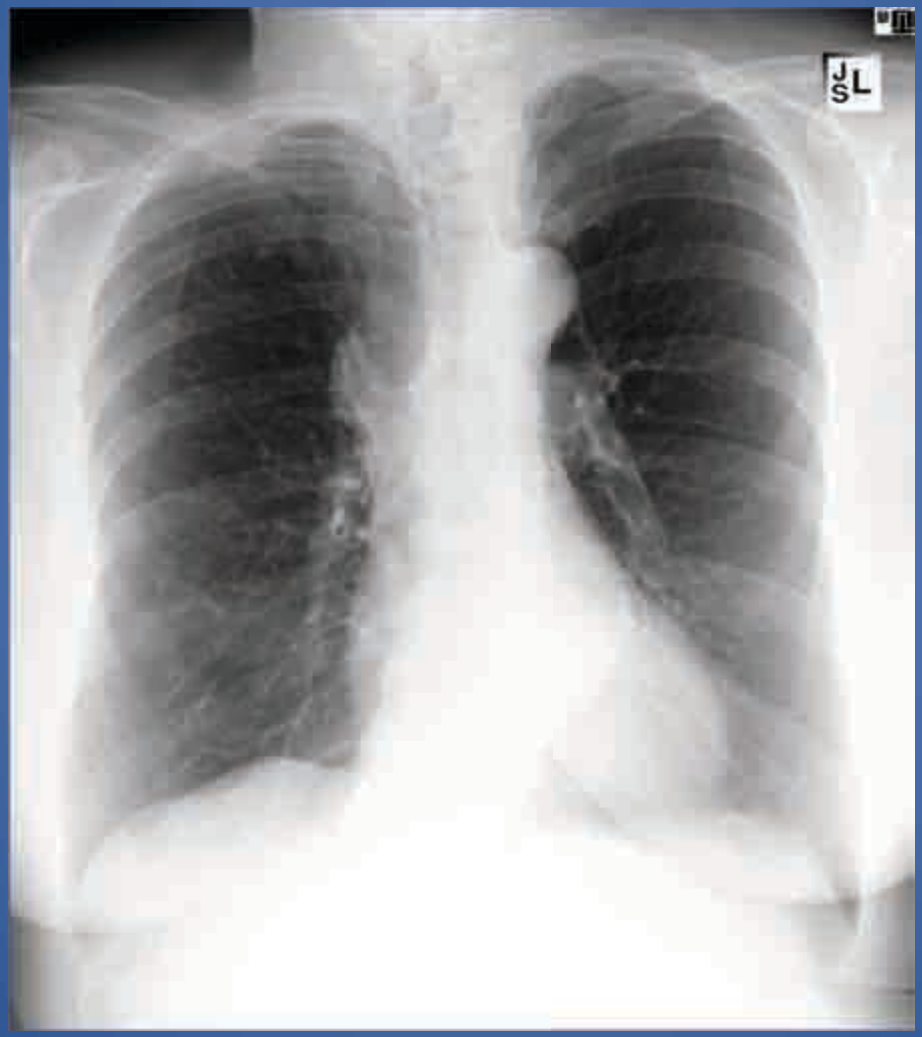


6 mo prior.

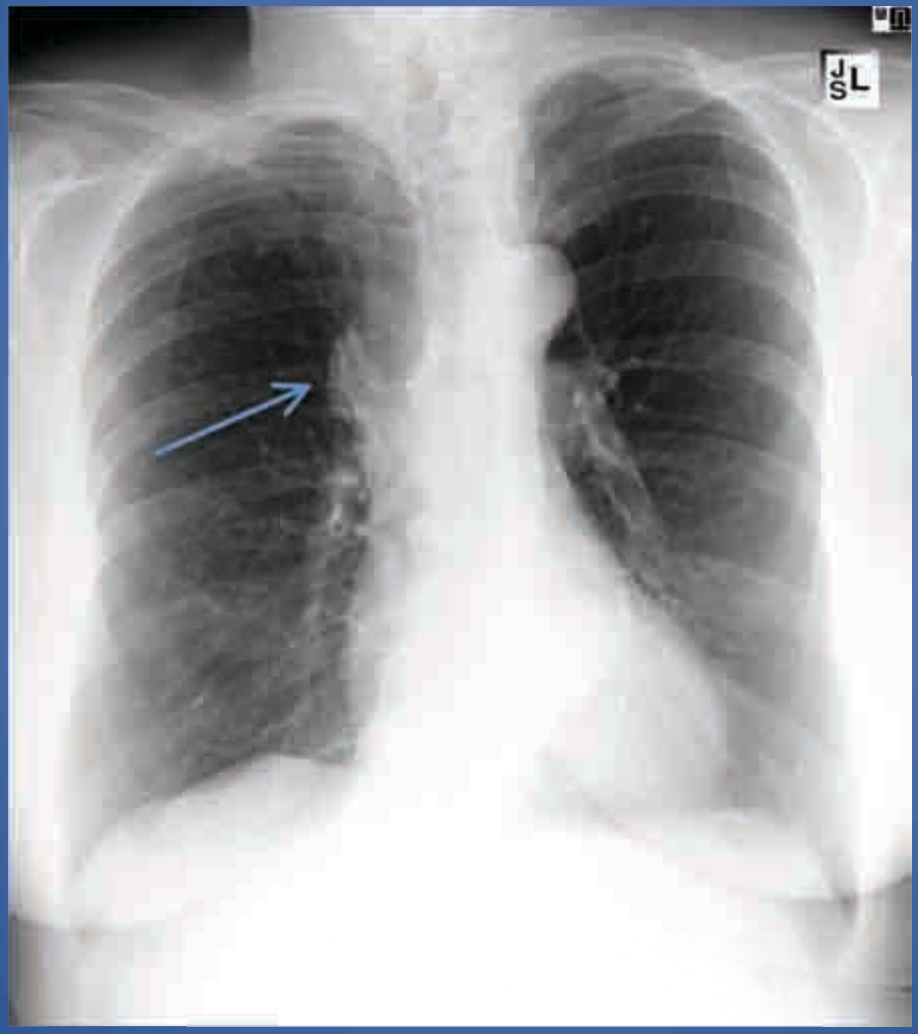
68 Year Old female with cough



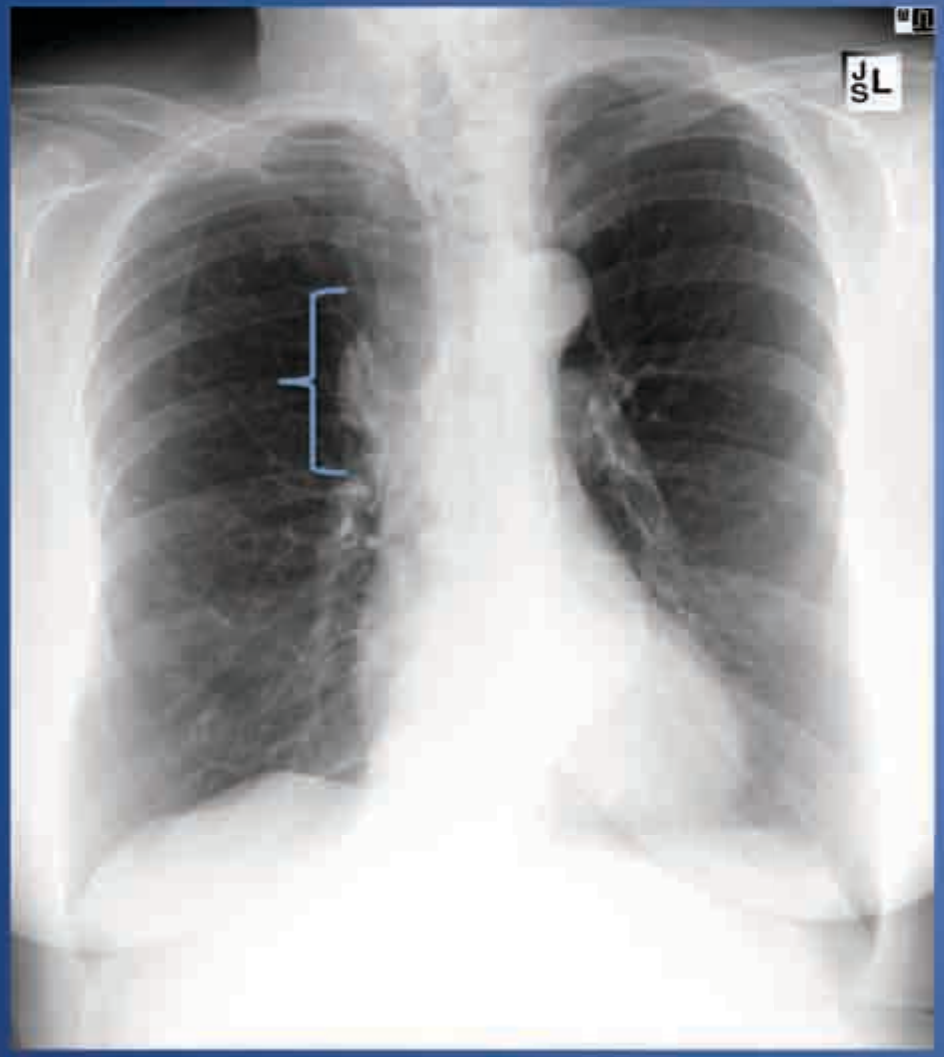
68 Year Old female with cough

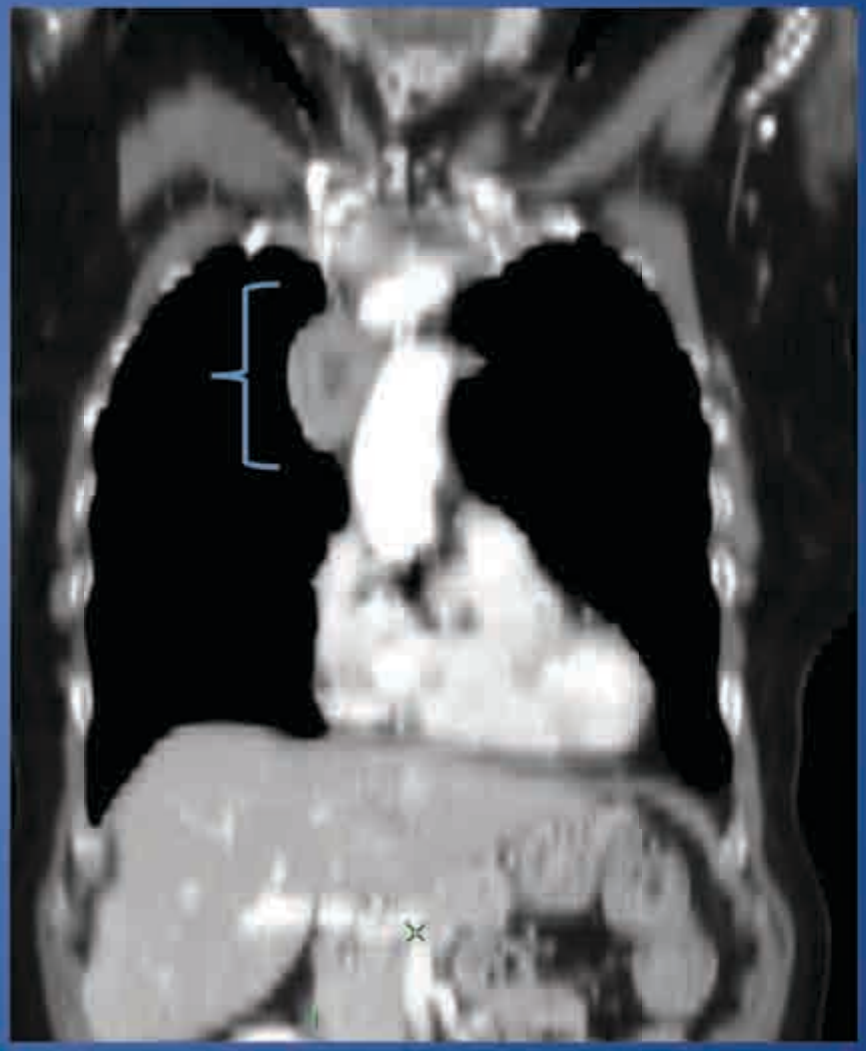


68 Year Old female with cough

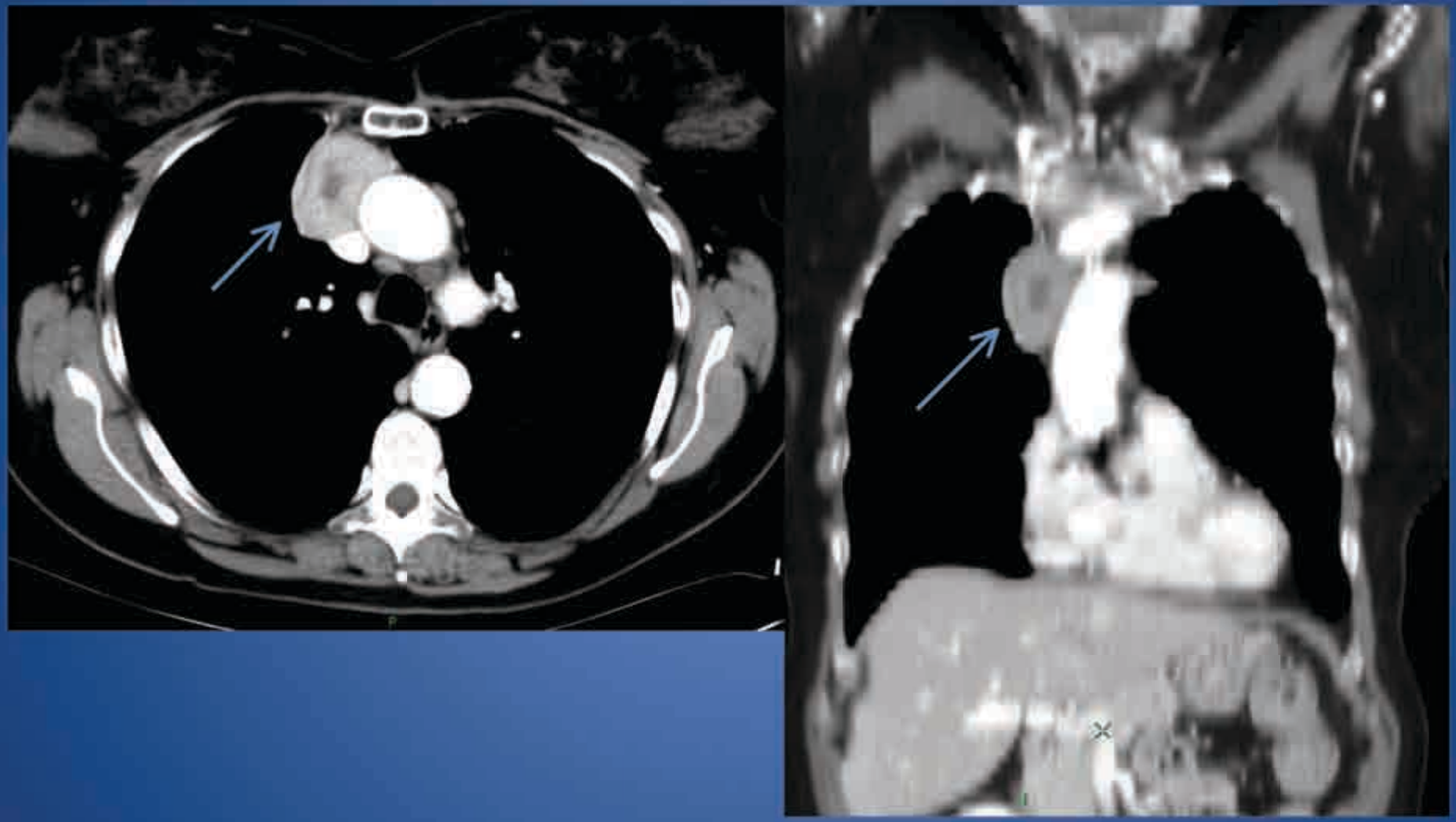


68 Year Old female with cough

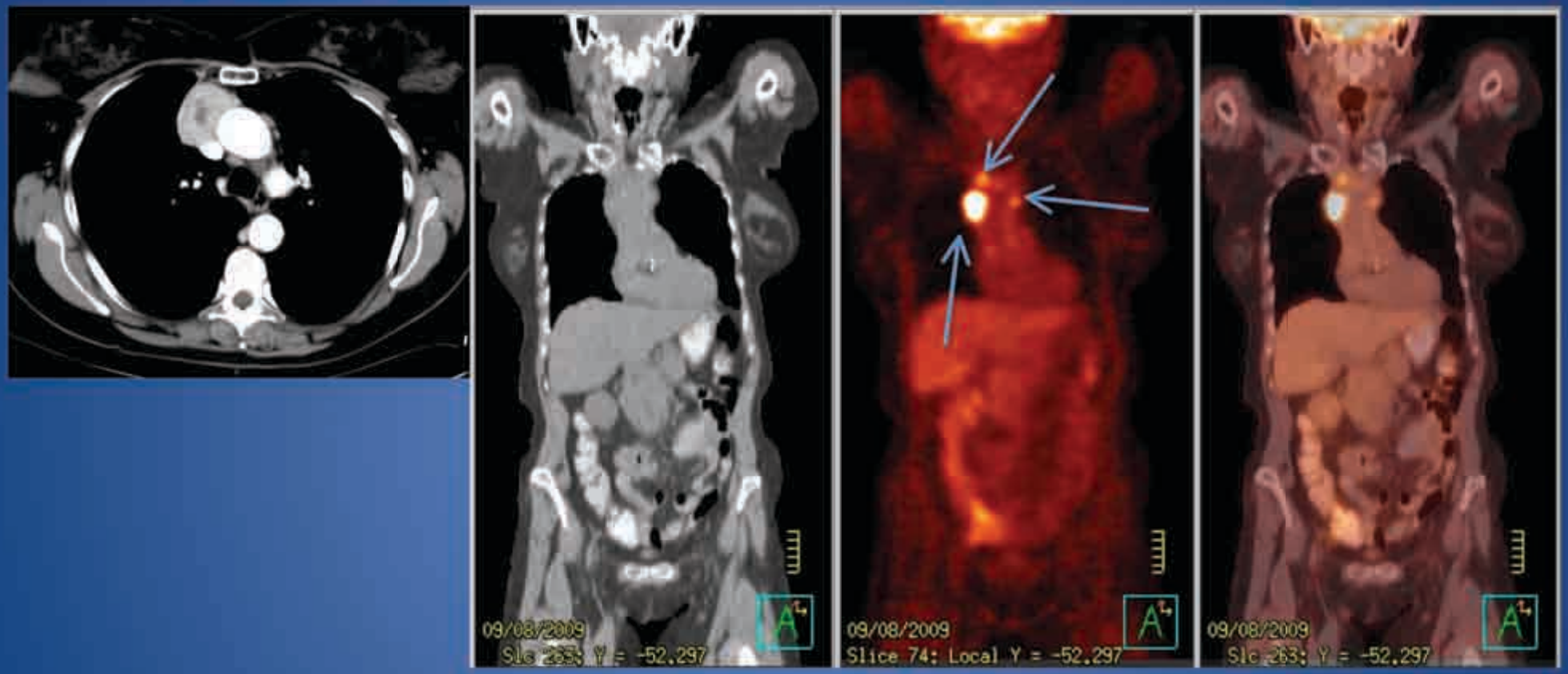




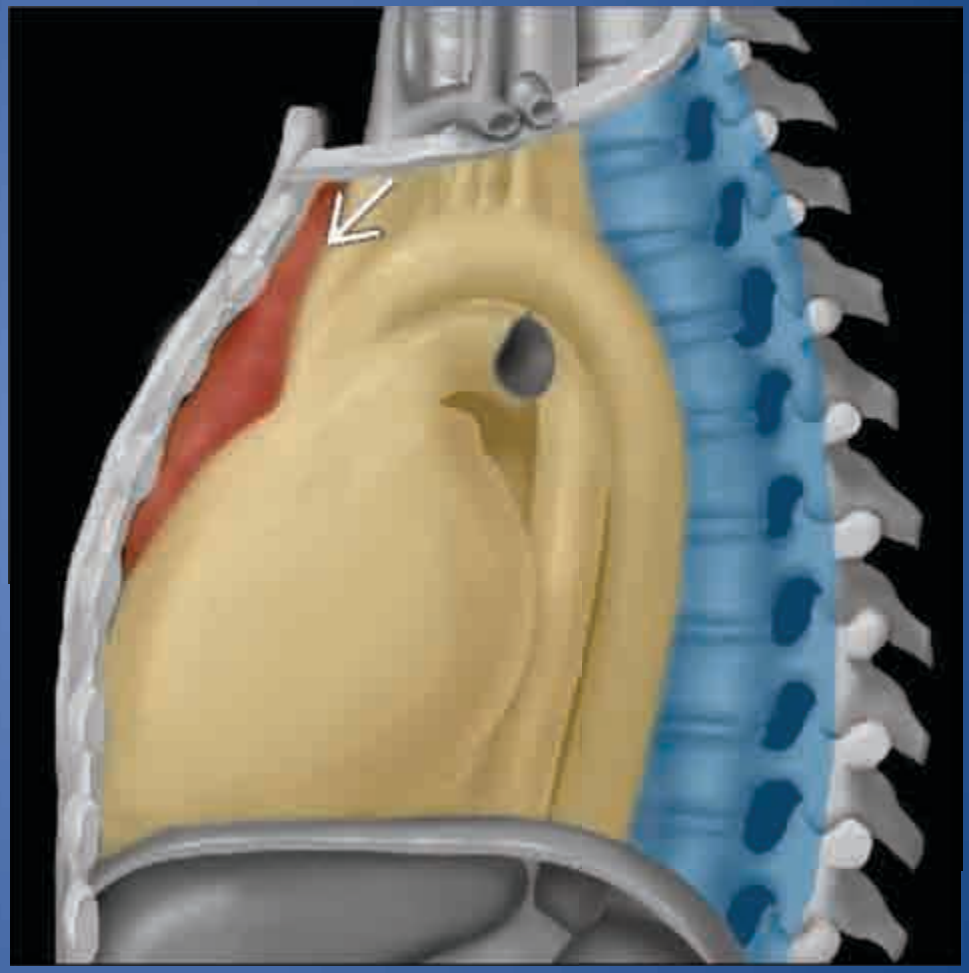
68 Year Old female with cough



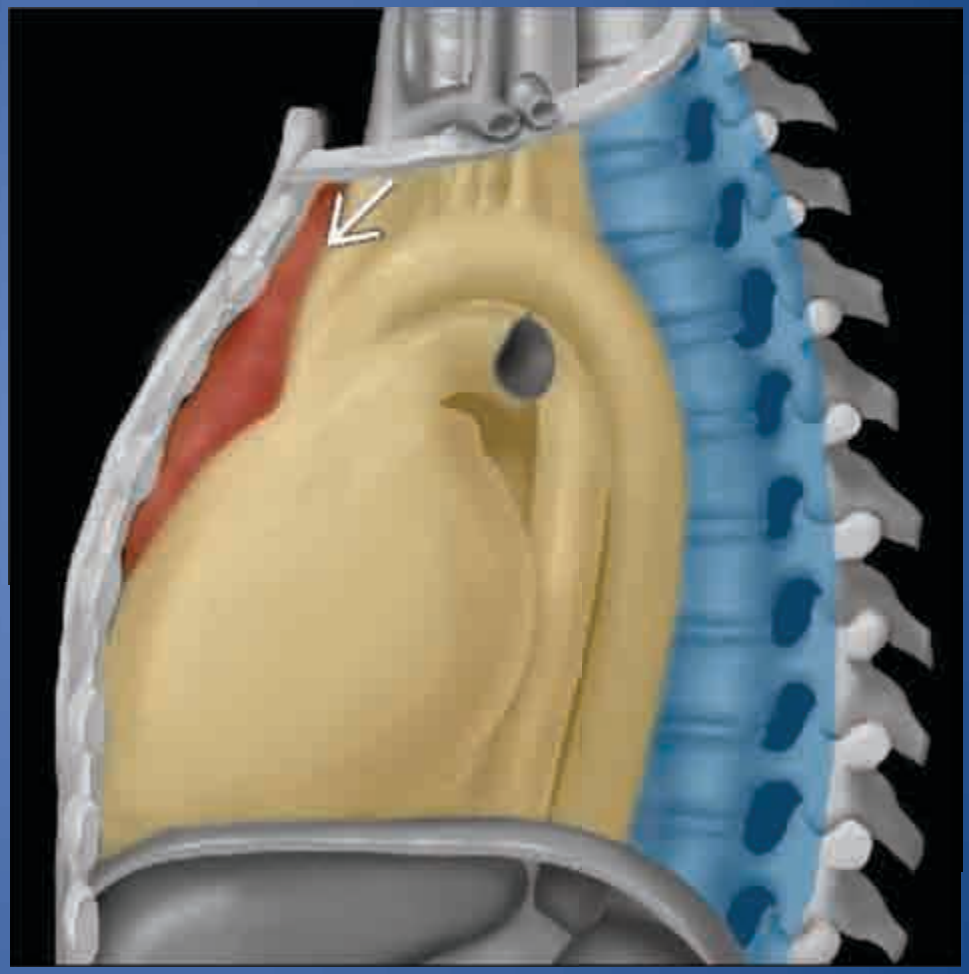
68 Year Old female with cough



Anterior Mediastinal Mass

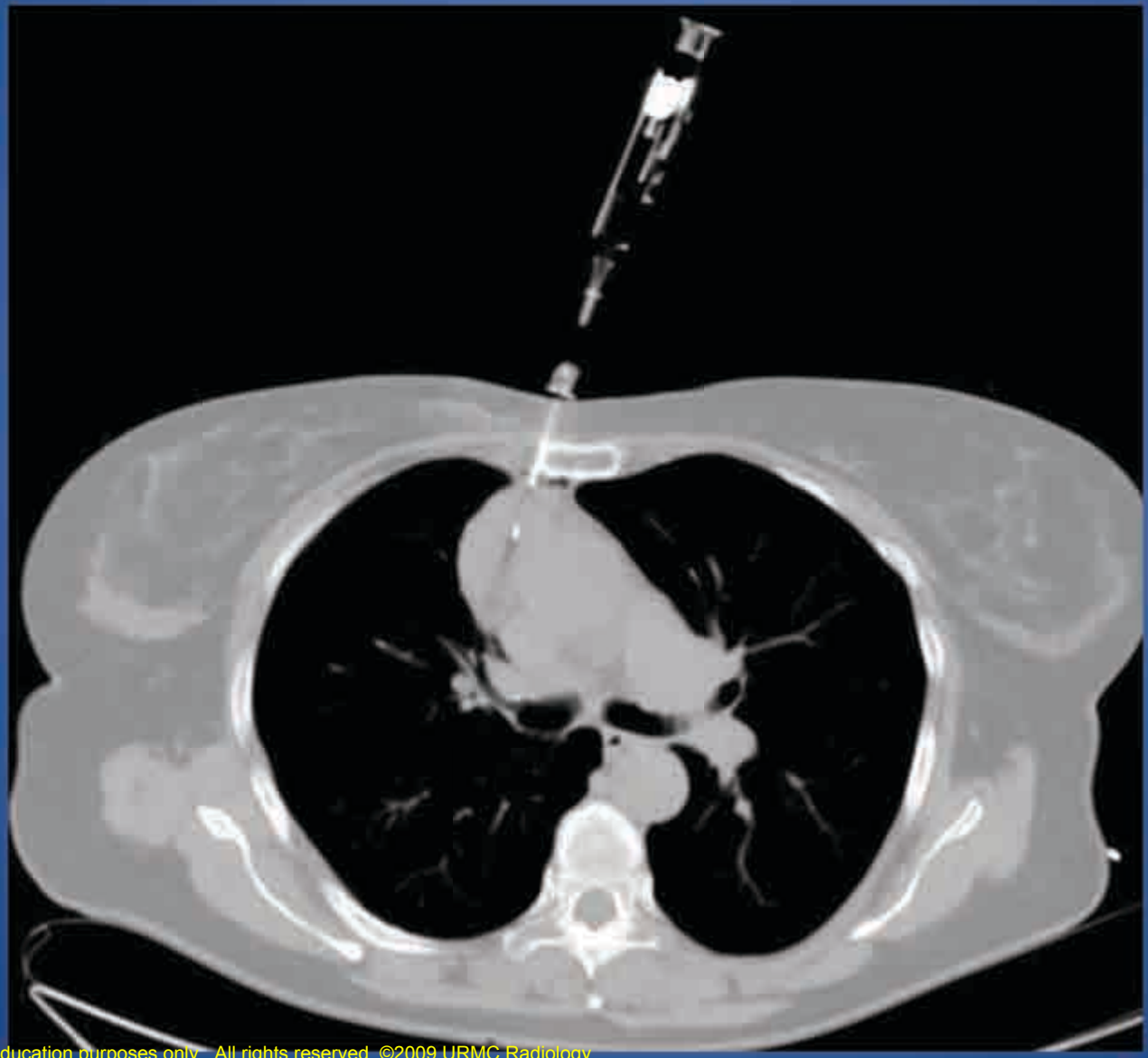


Anterior Mediastinal Mass

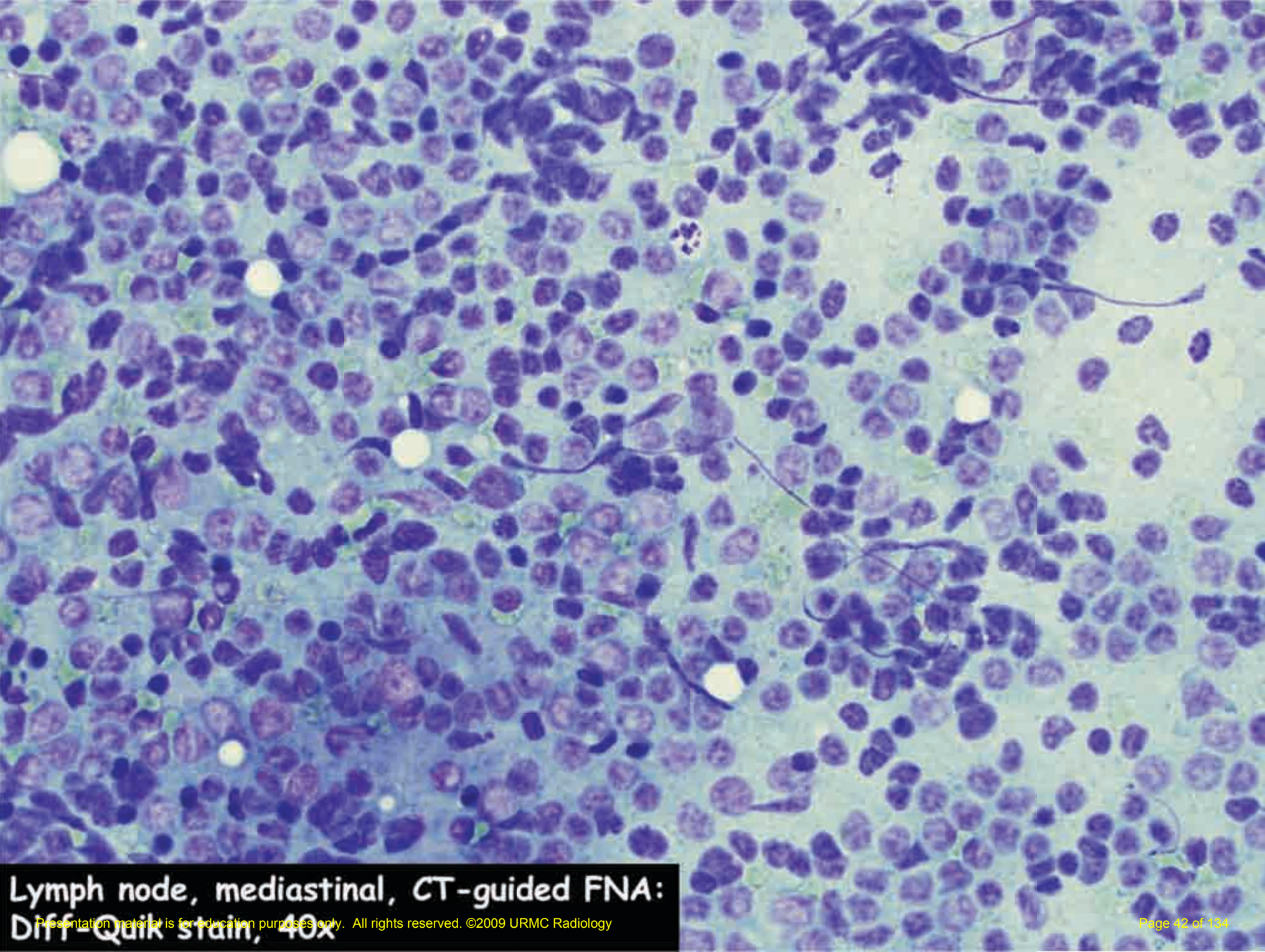


- Thyroid Lesions
- Thymic Lesions
- Lymphoma
- Teratoma and other germ cell tumors

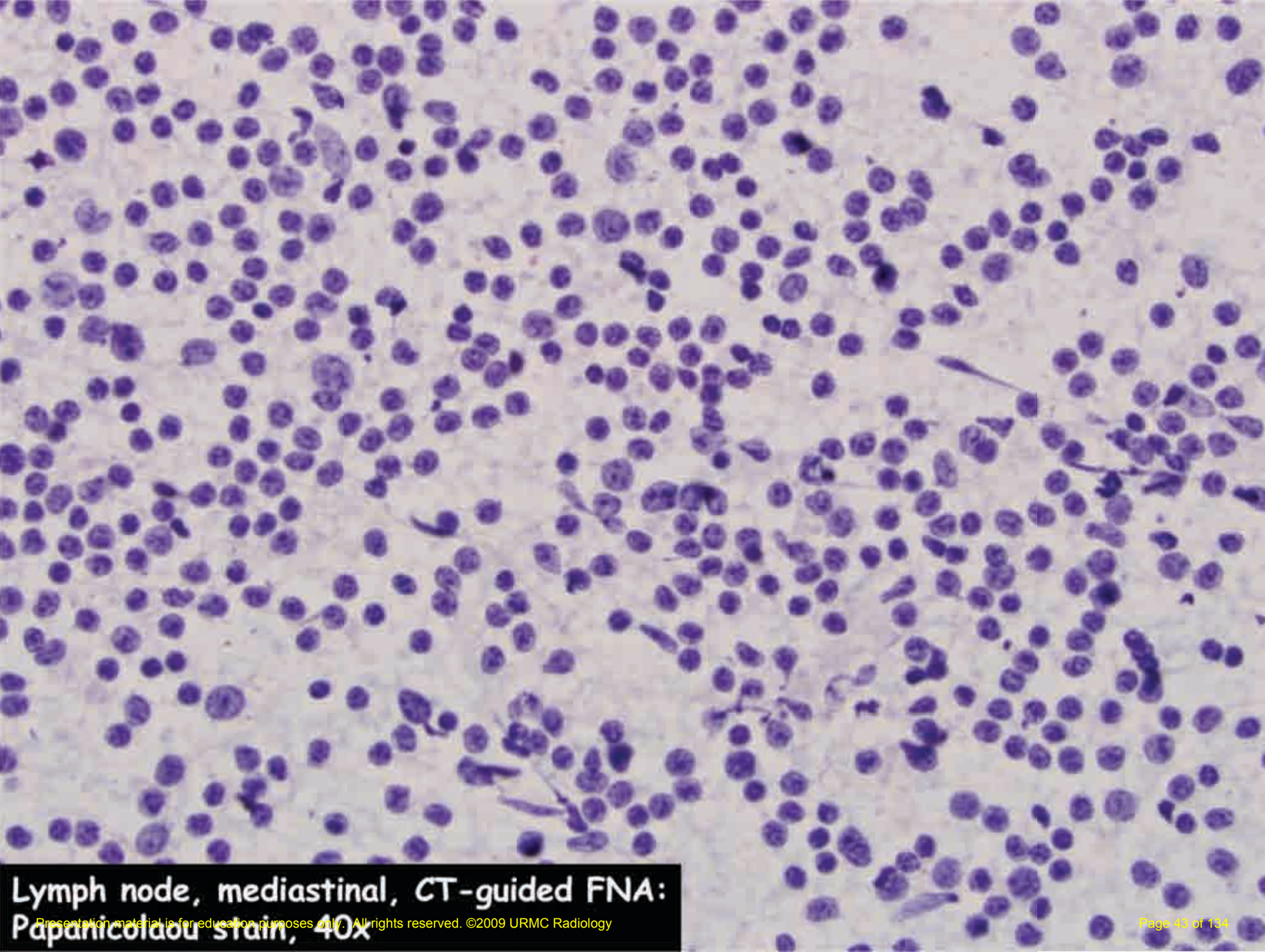
CT Guided Biopsy



Case 2



Lymph node, mediastinal, CT-guided FNA:
Diff-Quik stain, 40x



Lymph node, mediastinal, CT-guided FNA:
Papanicolaou stain, 40x

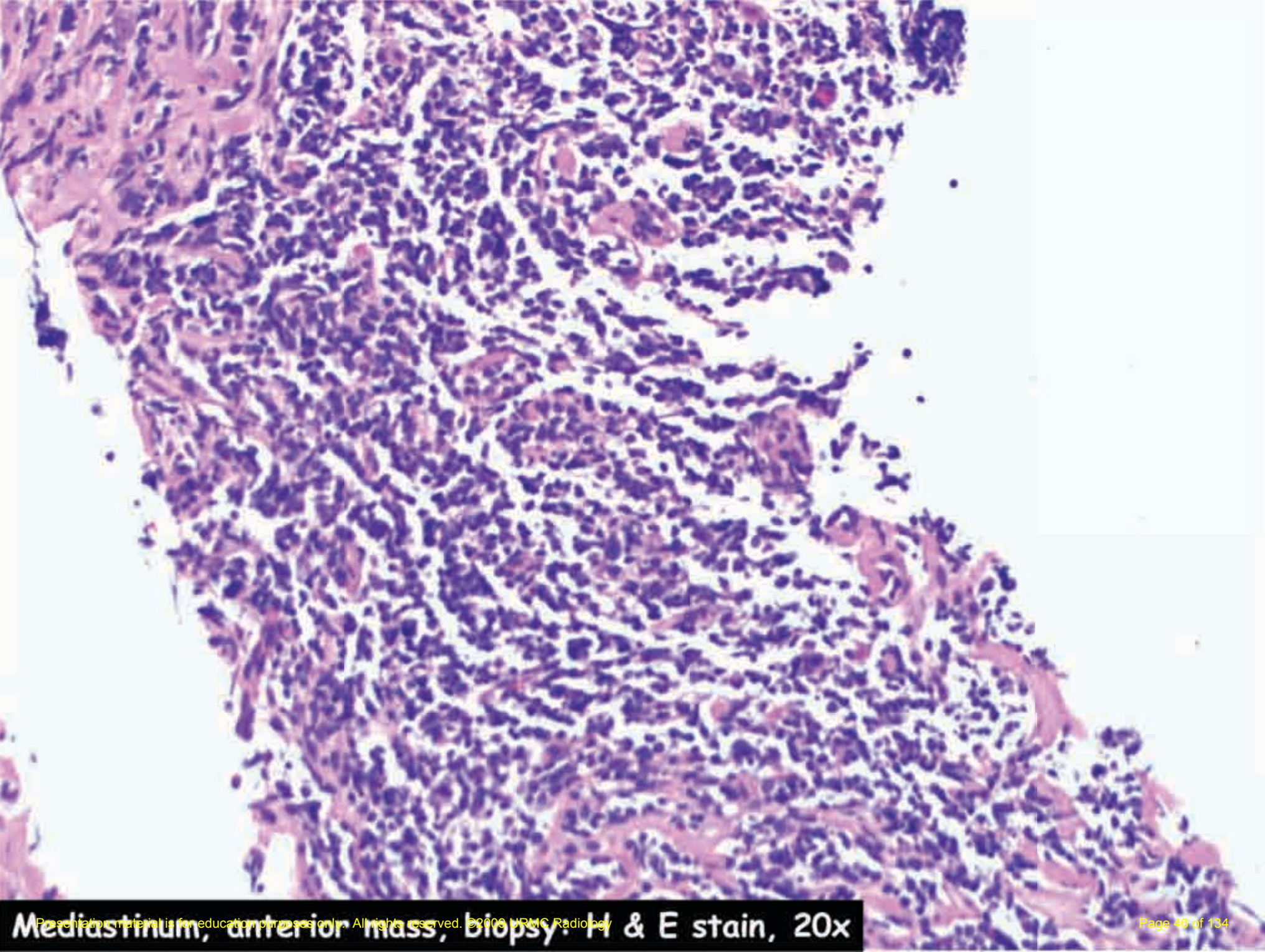
Lymph node, mediastinal, CT-guided fine needle aspiration:

Atypical lymphocytic proliferation, suspicious for lymphoma.

Specimen consists of two populations of lymphocytes; small and large. The differential diagnosis includes follicular lymphoma and large B-cell lymphoma.

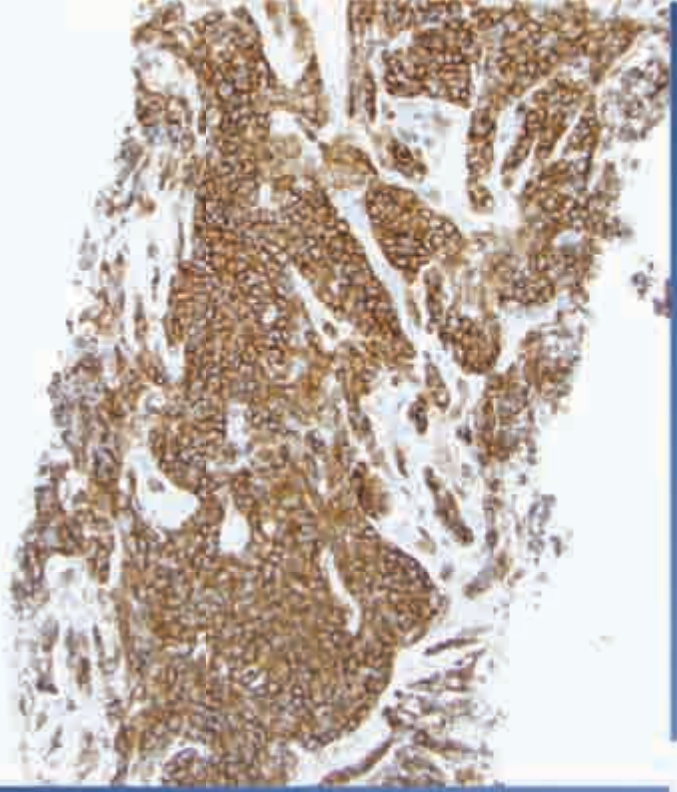
Mediastinum, anterior mass, biopsy:

Large B cell lymphoma.



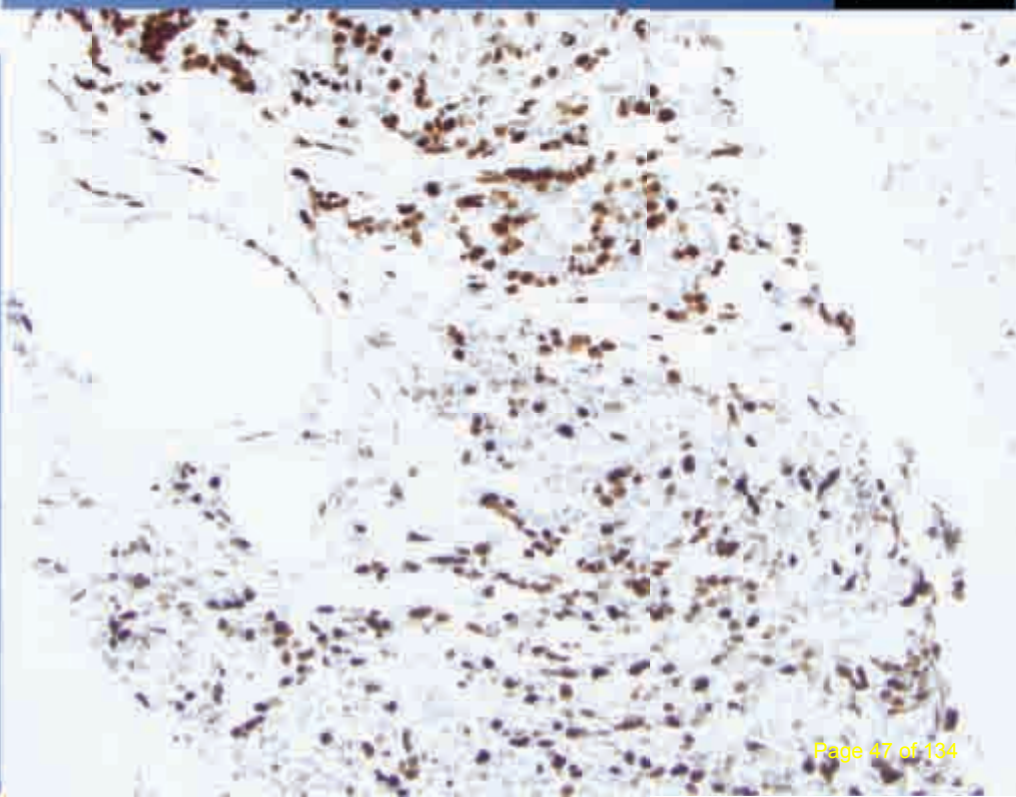
Mediastinum, anterior mass, biopsy: H & E stain, 20x

Mediastinum, anterior mass, biopsy:



CD20

Ki-67

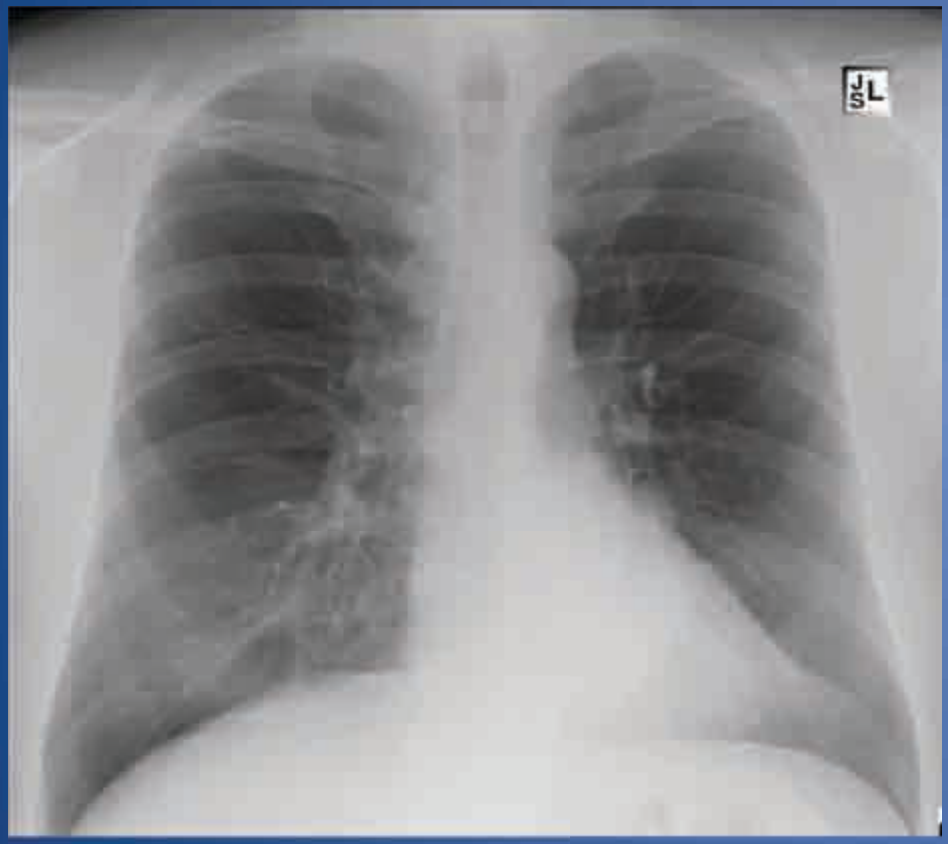


Suggested Panels for the Classification of Various Tumors

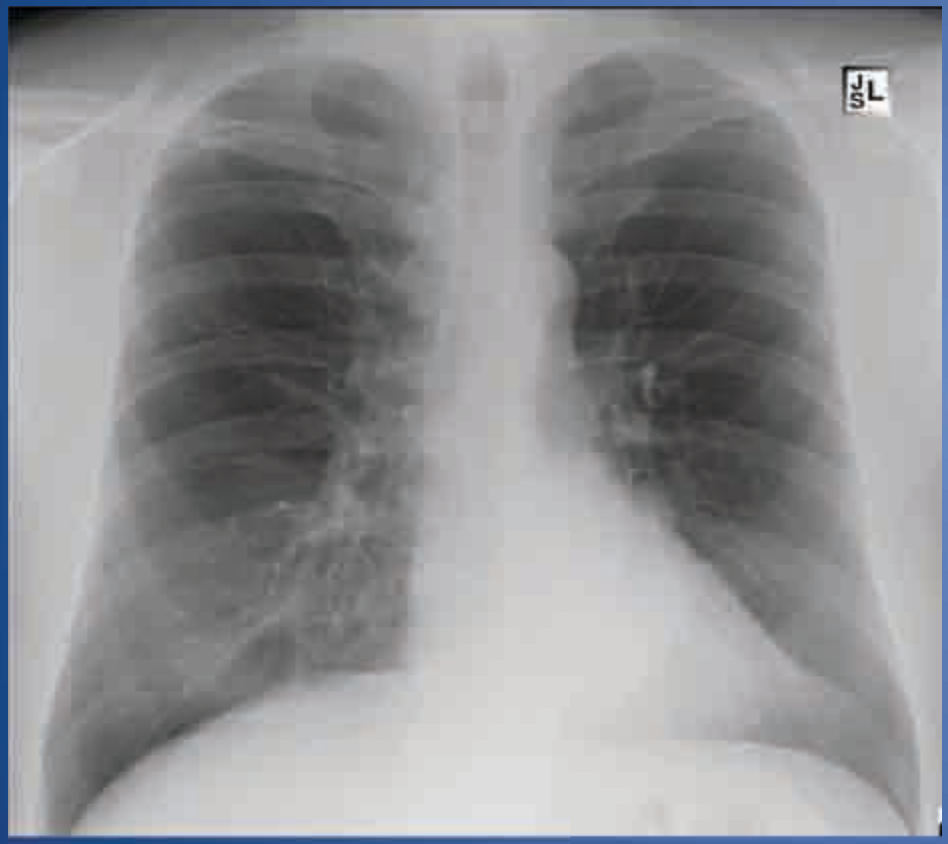
Tumor Type	First Tier	Second Tier
Carcinomas (Epithelial Tumors)	Pankeratin	CEA, EMA, B72.3, TTF-1, CalR, CK 5/6
Lymphomas	CD45	CD 3, CD 20, CD 30, Kappa, Lambda, CD 15
Sarcomas (Mesenchymal Tumors)	Vimentin	Myogenin, MSA, SMA, Sarc, F-8, S-100
Melanoma	Vim, S-100	HMB-45, Mel A, NSE
Neural/NE	NSE, NF	Chromo, Leu-7, PGP Synap, GFAP

Case 3

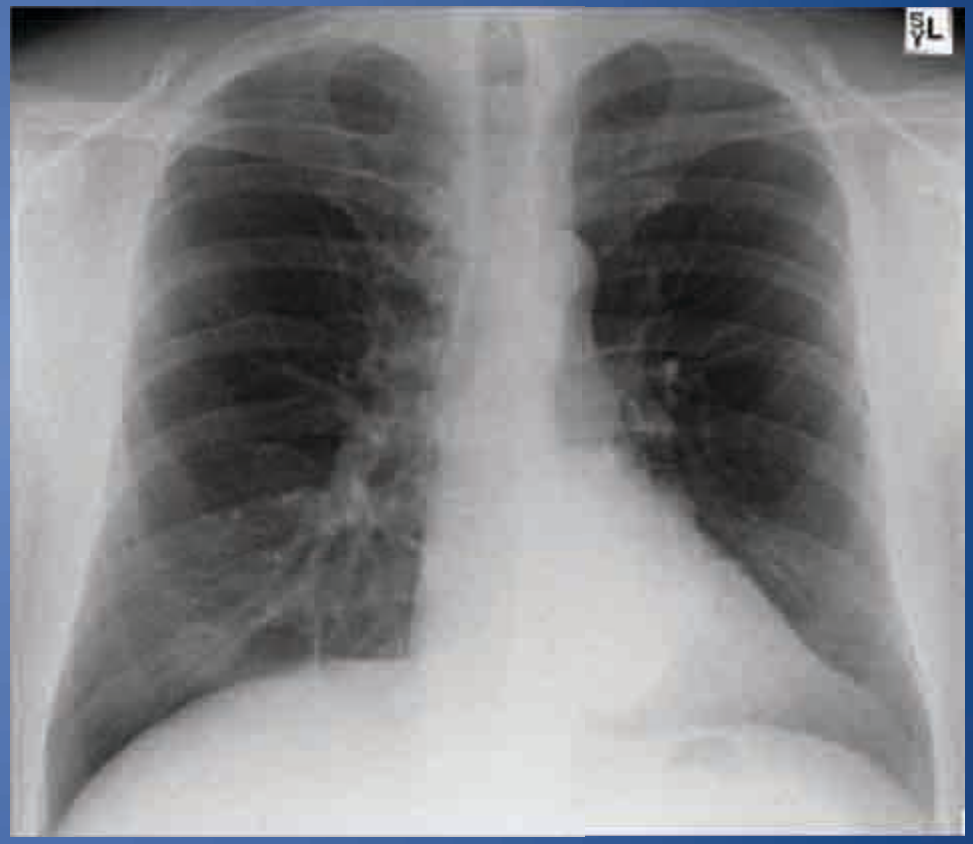
- 59 Year Old Male
- Presents with cough
- PMH significant for Colon Cancer



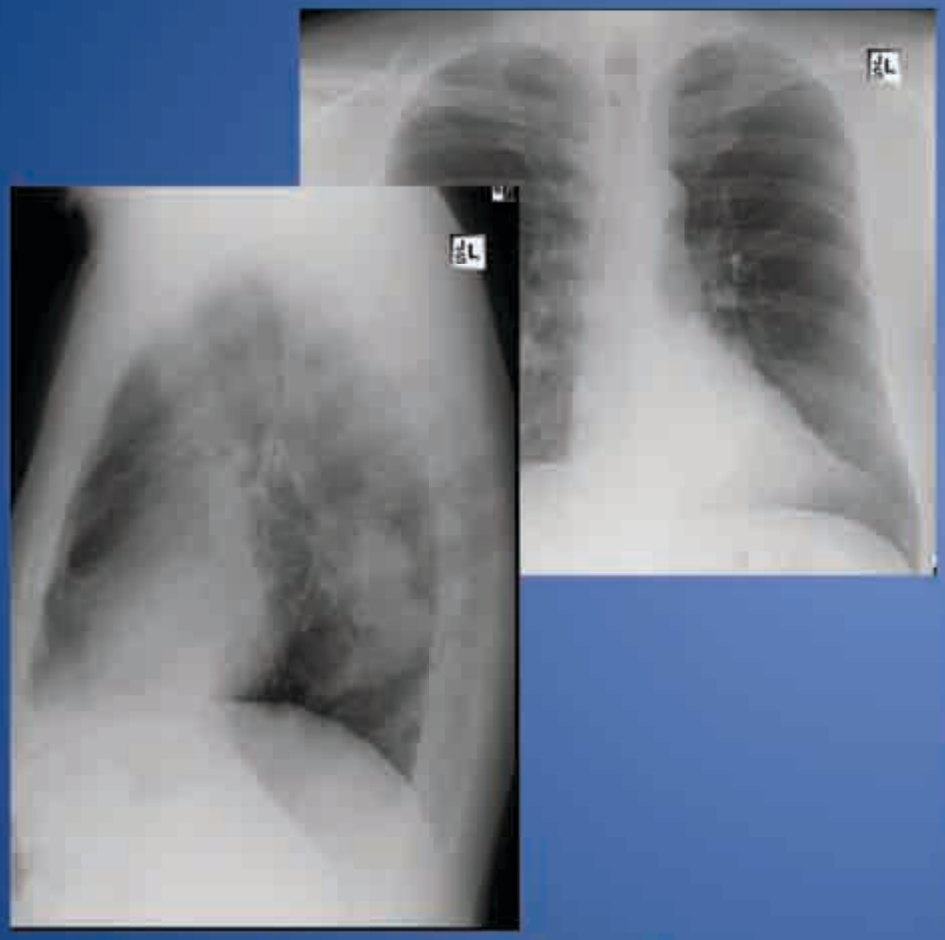
Presents with Cough



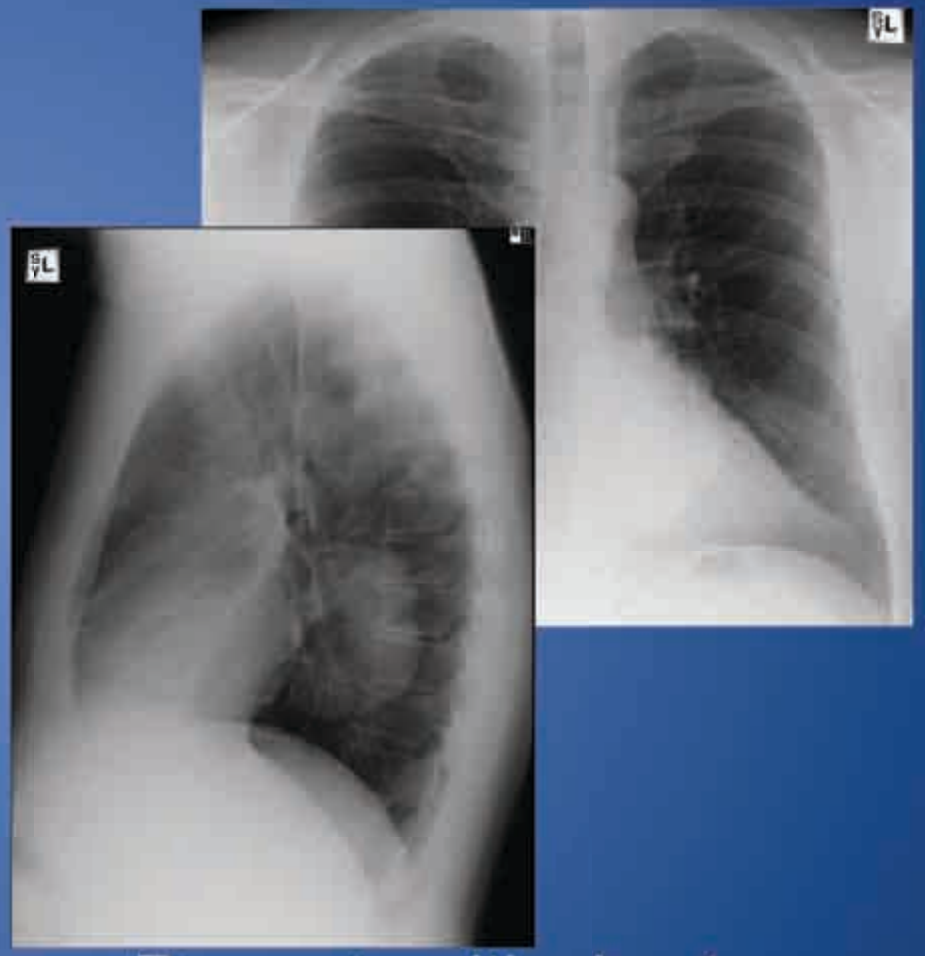
Presents with Cough



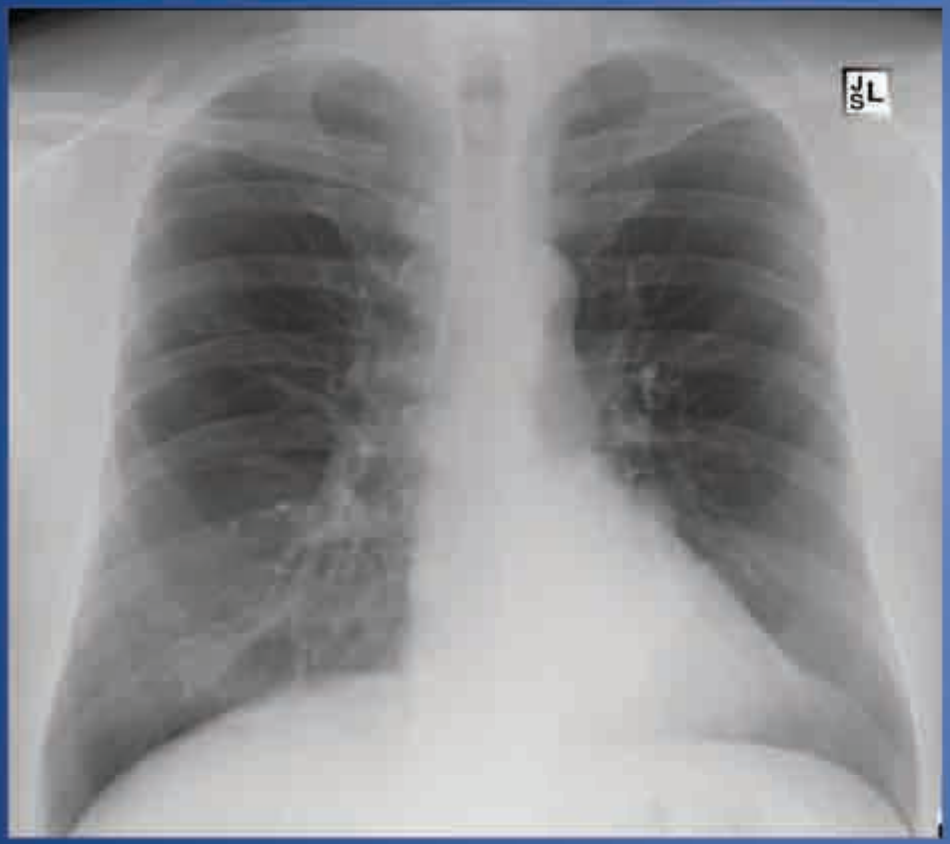
Presents with chest pain 3 days later



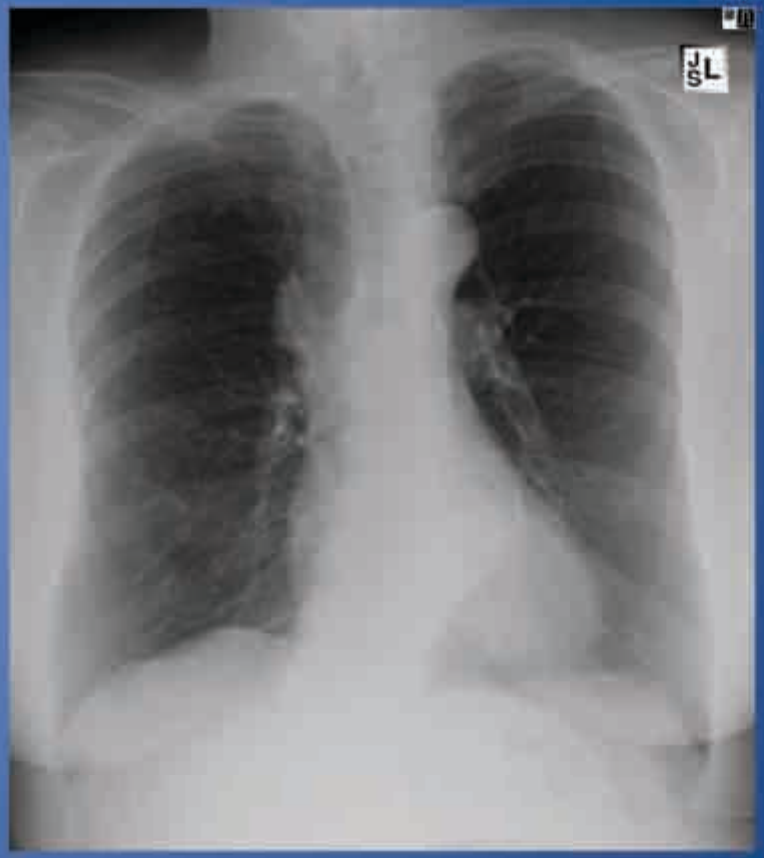
Presents with Cough



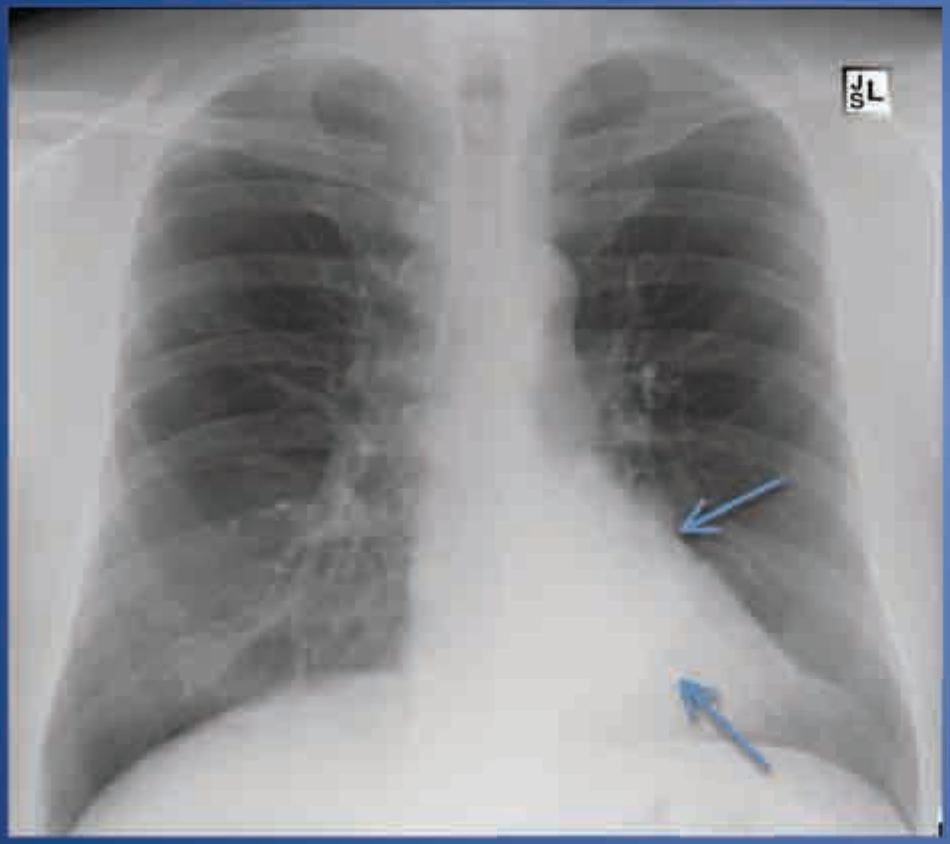
Presents with chest pain 3 days later



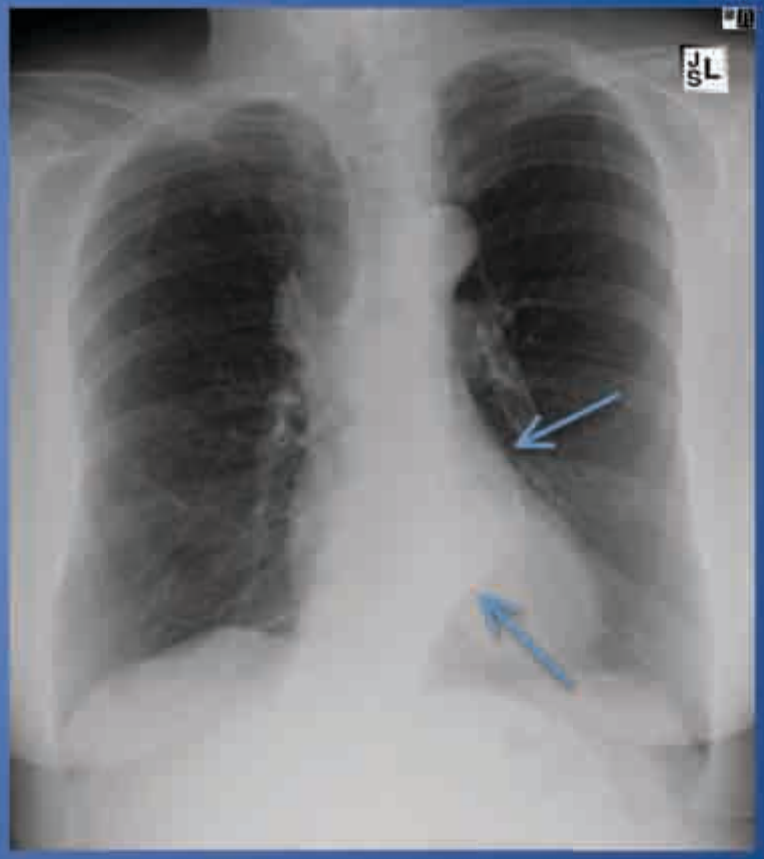
Presents with Cough



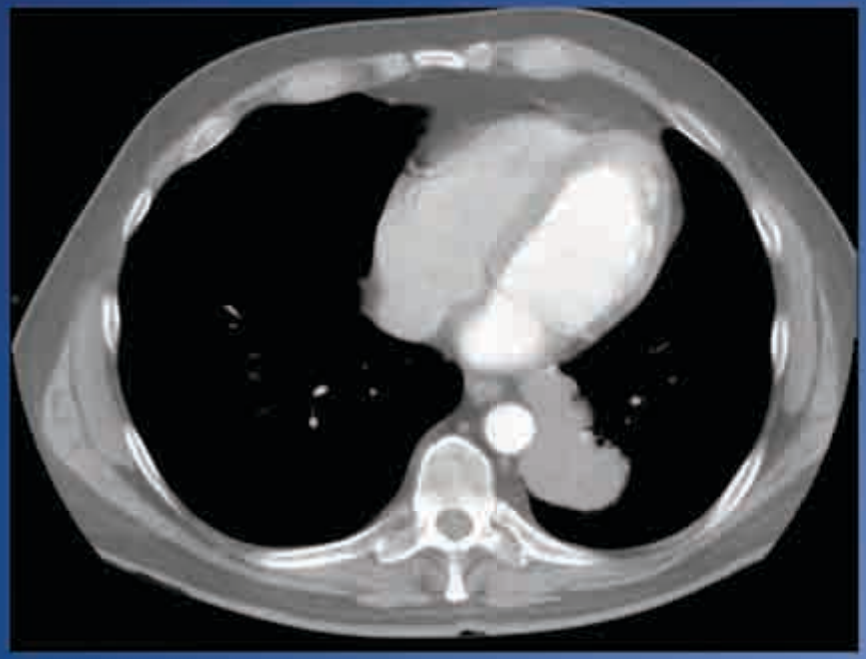
Patient from previous case

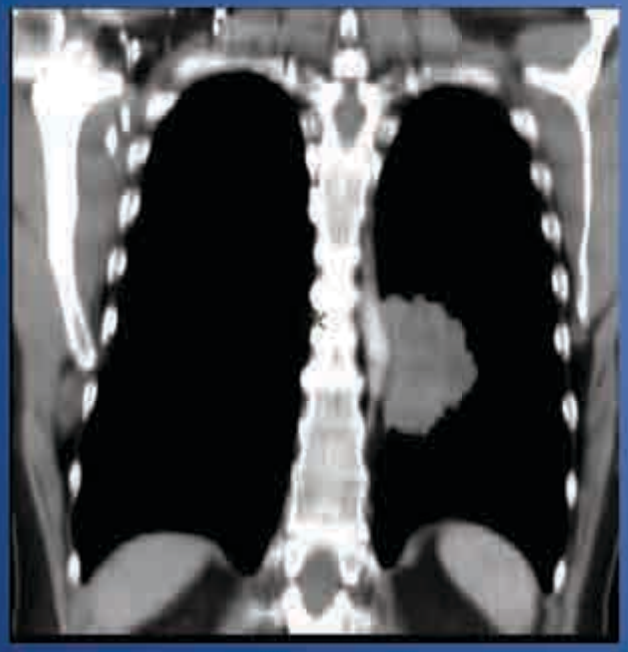


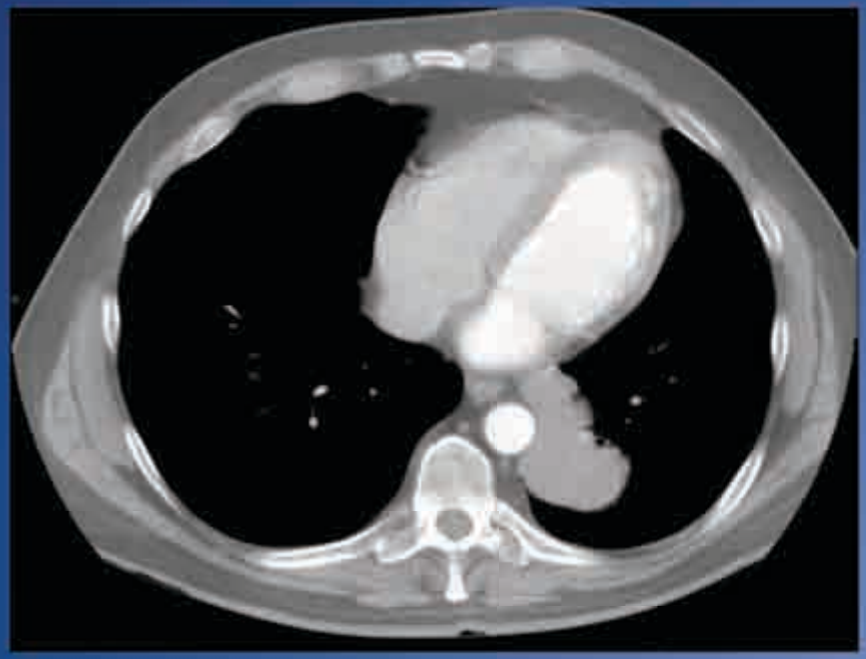
Presents with Cough

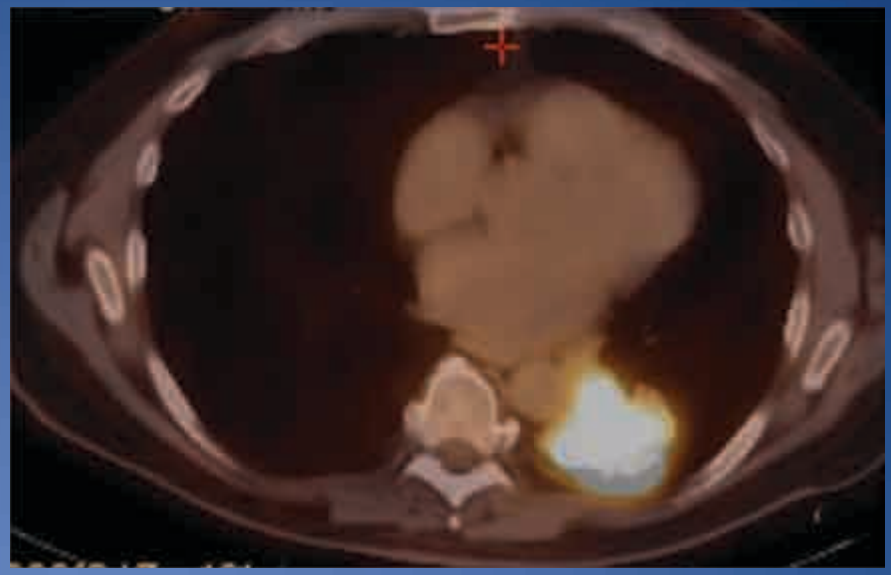


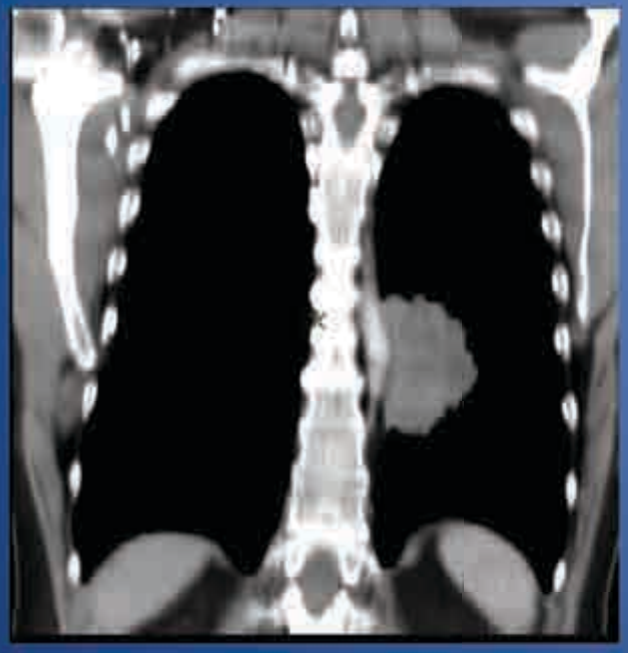
Patient from previous case

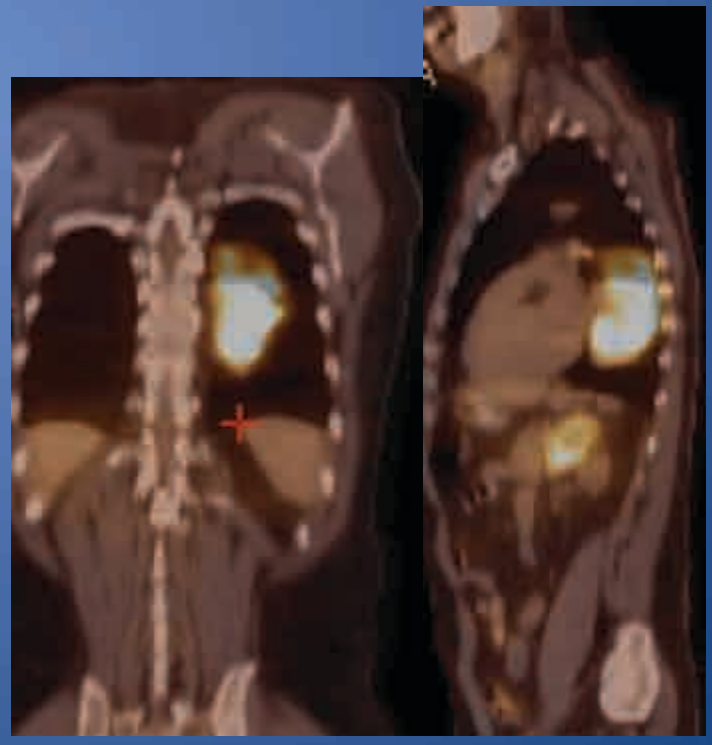


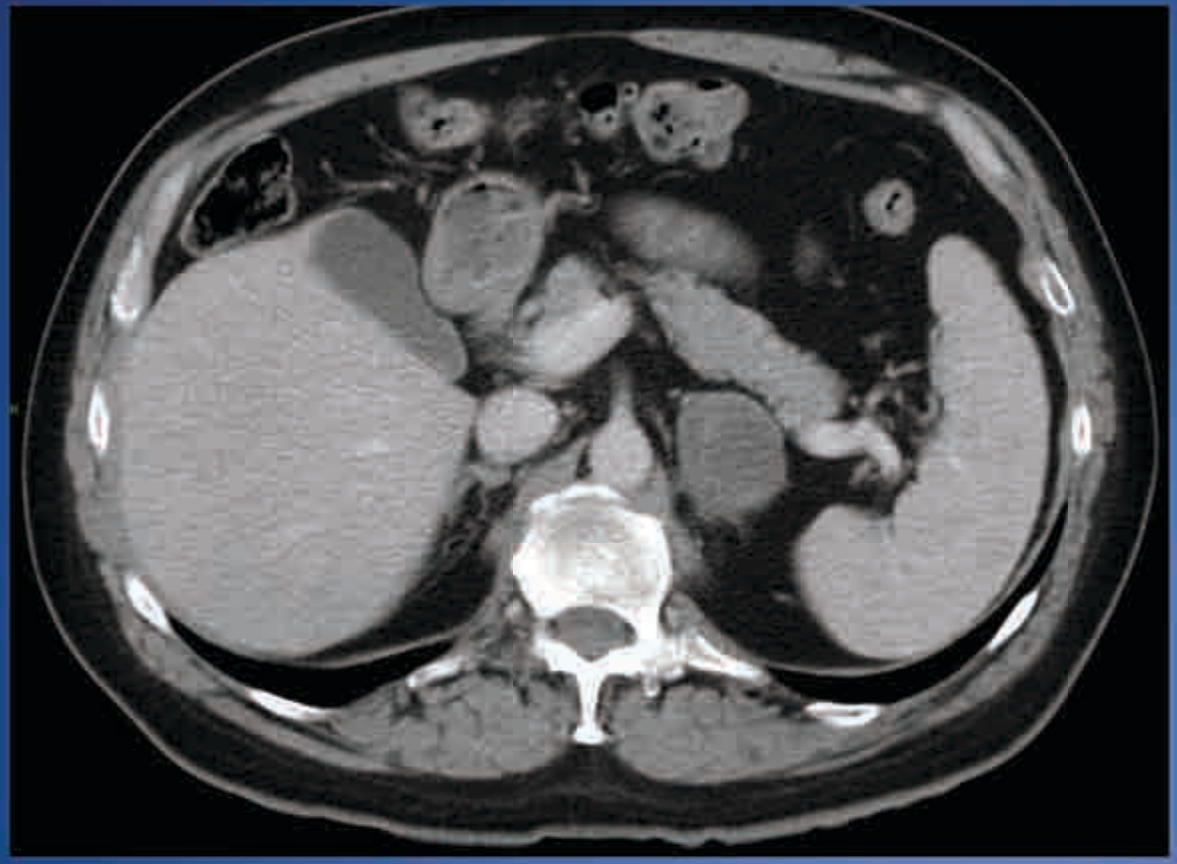


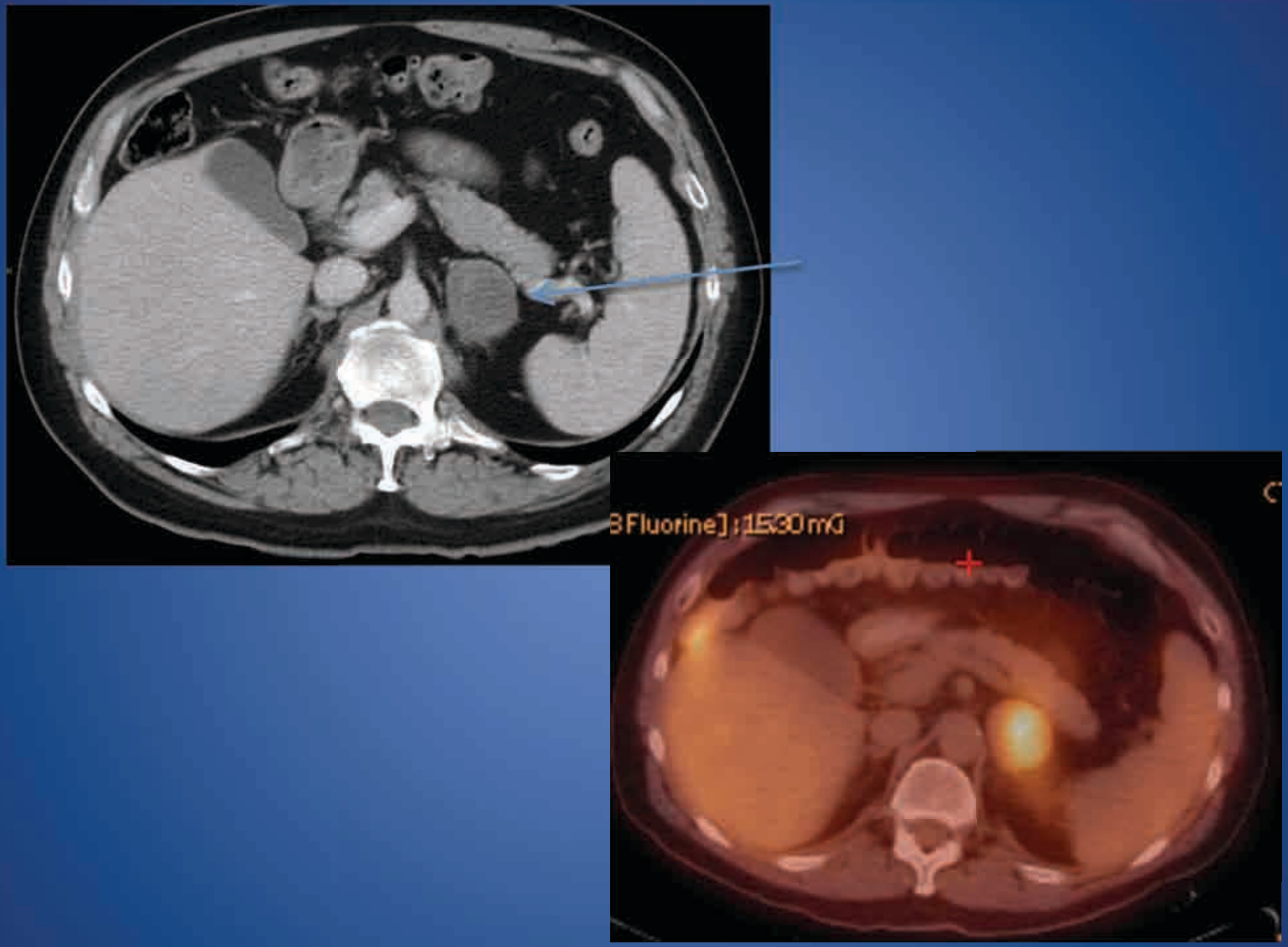


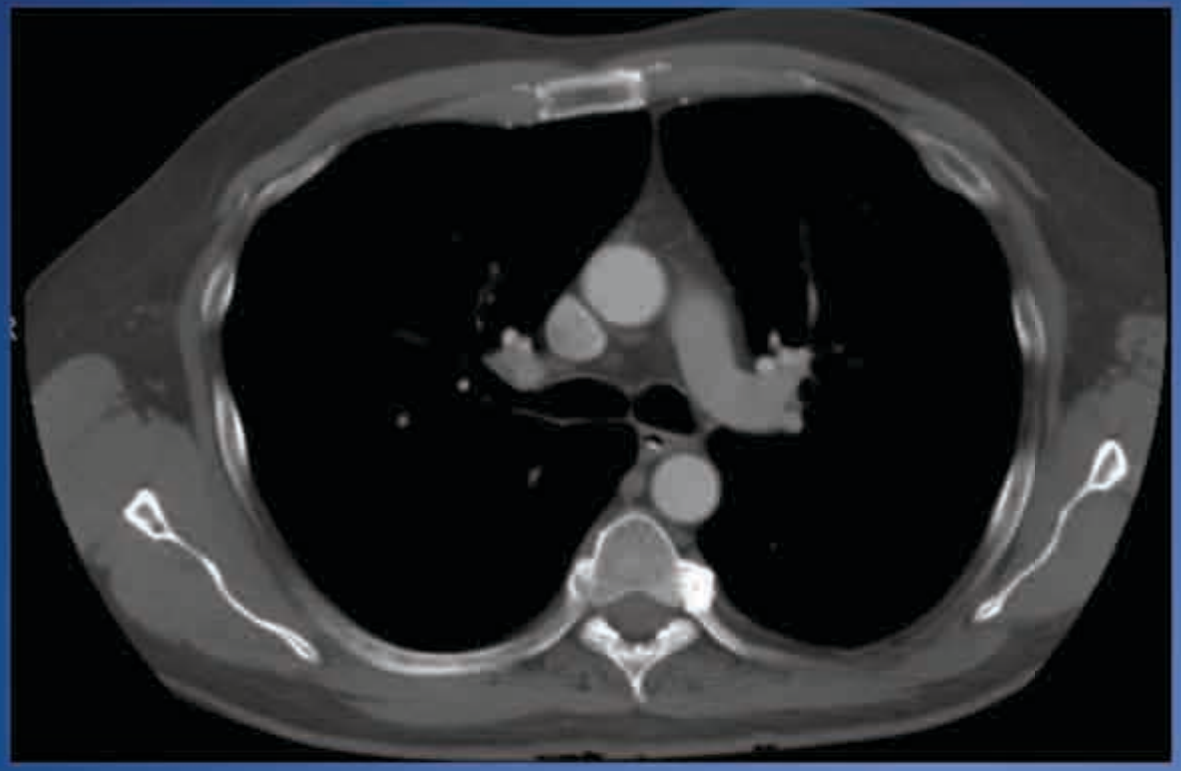


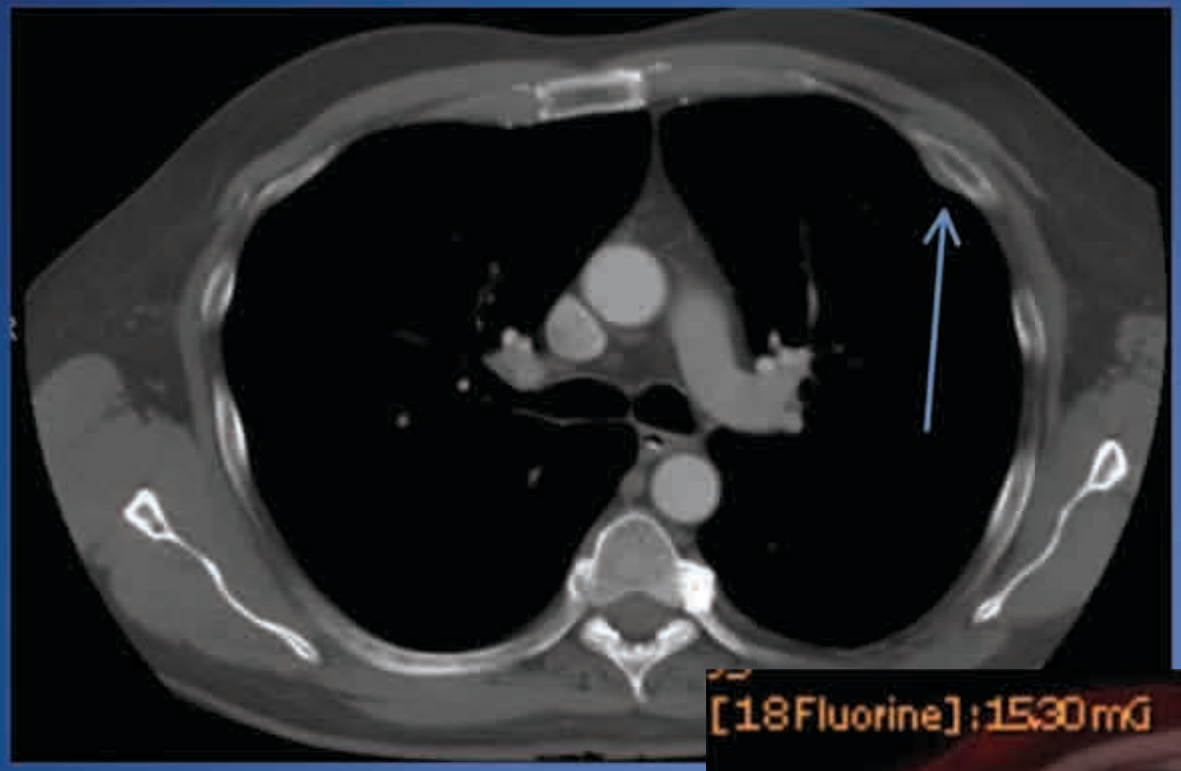


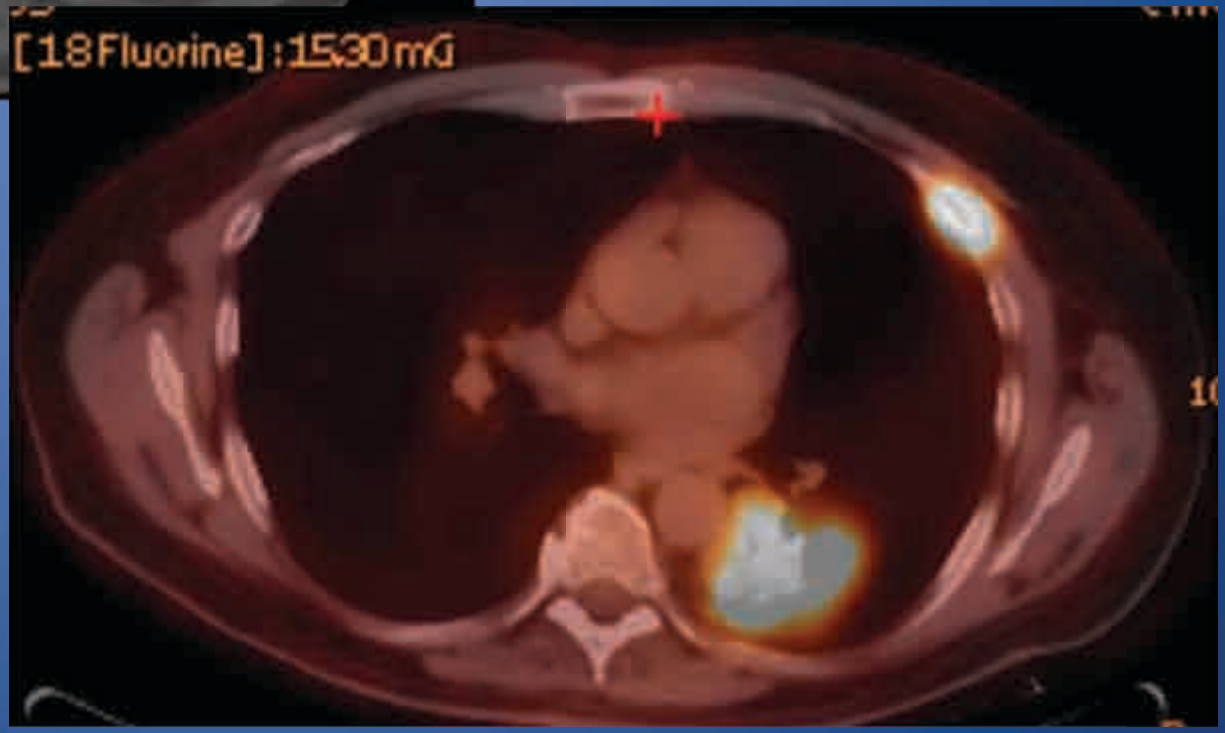












Recap: History of Colon Cancer

- 8x8x6 cm Left lower lobe lung mass

Recap: History of Colon Cancer

- 8x8x6 cm Left lower lobe lung mass

Extrapulmonary malignancy	# of patients	% with metastasis	% with lung cancer	% with benign
Head & Neck squamous cell	33	9	76	15
Lymphoma or leukemia	14	0	57	43
Carcinoma: urinary bladder, breast, cervix, bile ducts, esophagus, ovary, prostate, stomach	45	18	58	24
Carcinoma: salivary gland, adrenal, colon, parotid, kidney, thyroid, thymus, uterus	31	52	42	6
Melanoma, sarcoma, testis	38	60	24	16

adapted from Quint et al.

Recap: History of Colon Cancer

- 8x8x6 cm Left lower lobe lung mass

Extrapulmonary malignancy	# of patients	% with metastasis	% with lung cancer	% with benign
esophagus, ovary, prostate, etc				
Carcinoma: salivary gland, adrenal, colon, parotid, kidney, thyroid, thymus, uterus	31	52	42	6
Melanoma, sarcoma, testis	38	[illegible]	[illegible]	16

adapted from Quint et al.

Recap: History of Colon Cancer

- 8x8x6 cm Left lower lobe lung mass

Extrapulmonary malignancy	# of patients	% with metastasis	% with lung cancer	% with benign
esophagus, ovary, prostate, etc				
Carcinoma: salivary gland, adrenal, colon, parotid, kidney, thyroid, thymus, uterus	31	52	42	6
Melanoma, sarcoma, testis	38			16

adapted from Quint et al.

- Hypermetabolic Left adrenal mass
- Hypermetabolic Left rib lesion

Recap: History of Colon Cancer

- 8x8x6 cm Left lower lobe lung mass

Extrapulmonary malignancy	# of patients	% with metastasis	% with lung cancer	% with benign
esophagus, ovary, prostate, etc				
Carcinoma: salivary gland, adrenal, colon, parotid, kidney, thyroid, thymus, uterus	31	52	42	6
Melanoma, sarcoma, testis	38			16

adapted from Quint et al.

- Hypermetabolic Left adrenal mass
- Hypermetabolic Left rib lesion

No Liver Lesions

Diagnosing Colon Cancer

Gold standard for evaluation is Optical colonoscopy

Virtual Colonoscopy/ CT Colonography is an alternative.

Not covered by Medicare as of May 2009.

Some private insurance will pay for exams. Specifically, BCBS does.

Virtual Colonoscopy

VC is less invasive and hopefully more patients will comply with colon cancer screening.

Virtual vs Optical Colonoscopy

VC

OC

Virtual vs Optical Colonoscopy

VC	OC
Cost: $300 - $800	Cost: $3000

Virtual vs Optical Colonoscopy

VC	OC
Cost: $300 - $800	Cost: $3000
Requires Cleansing Prep	Requires Cleansing Prep

Virtual vs Optical Colonoscopy

VC	OC
Cost: $300 - $800	Cost: $3000
Requires Cleansing Prep	Requires Cleansing Prep
You have to insufflate the colon with air	You have to insert a 2 meter camera and fill with air.

Virtual vs Optical Colonoscopy

VC	OC
Cost: $300 - $800	Cost: $3000
Requires Cleansing Prep	Requires Cleansing Prep
You have to insufflate the colon with air	You have to insert a 2 meter camera and fill with air.
10 Minute exam	30-45 minute exam plus plus recovery time.

Virtual vs Optical Colonoscopy

VC

OC

Virtual vs Optical Colonoscopy

VC	OC
Visualize the whole colon, and can find extra colonic abnormalities.	10% of exams do not cover the entire right colon

Virtual vs Optical Colonoscopy

VC	OC
Visualize the whole colon, and can find extra colonic abnormalities.	10% of exams do not cover the entire right colon
Purely Diagnostic	Can biopsy lesions during exam

Virtual vs Optical Colonoscopy

VC	OC
Visualize the whole colon, and can find extra colonic abnormalities.	10% of exams do not cover the entire right colon
Purely Diagnostic	Can biopsy lesions during exam
High accuracy for lesions greater than 6mm (>90%)	More sensitive for lesions 5mm and smaller, and flat lesions.

Virtual vs Optical Colonoscopy

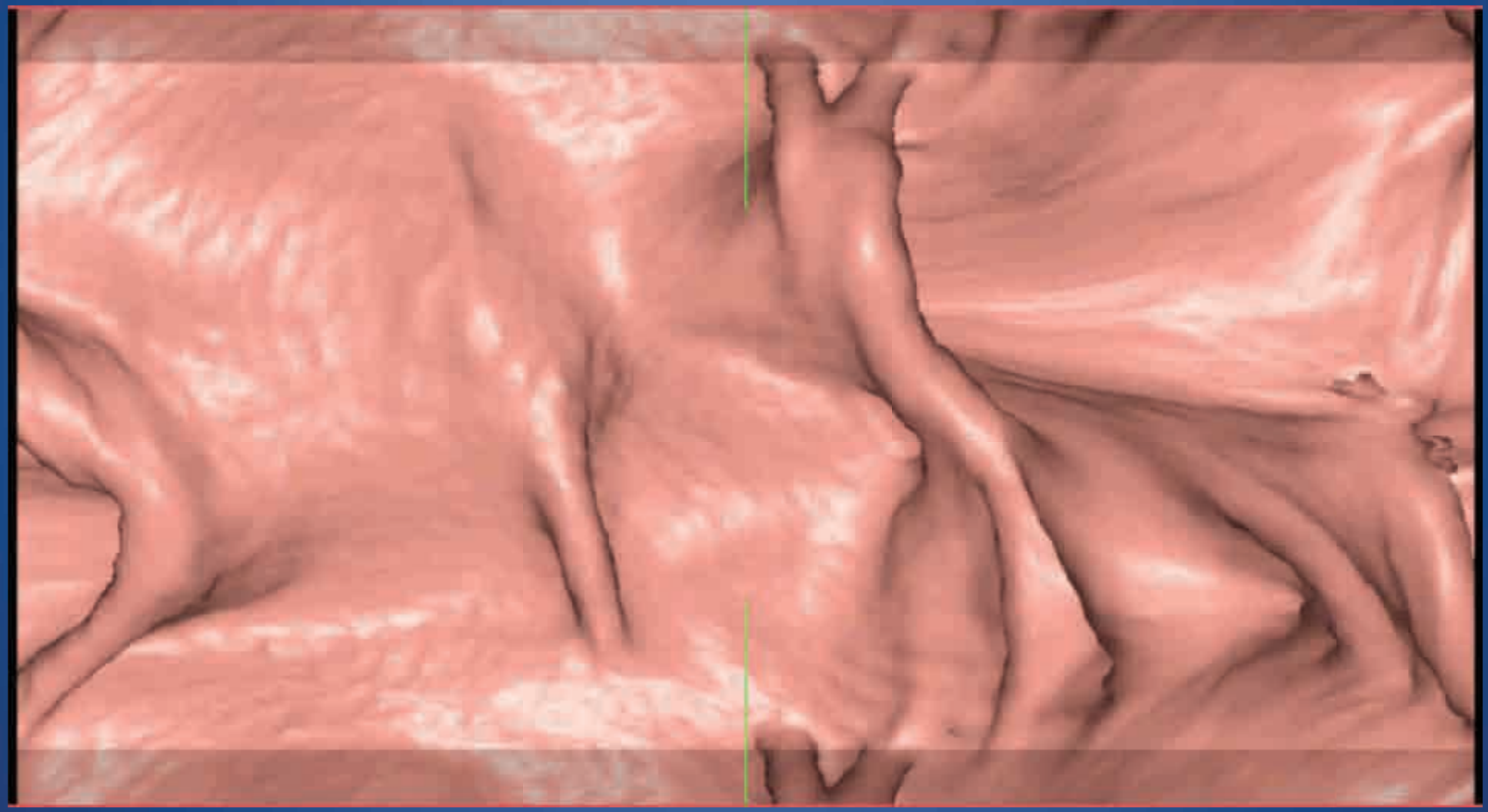
VC	OC
Visualize the whole colon, and can find extra colonic abnormalities.	10% of exams do not cover the entire right colon
Purely Diagnostic	Can biopsy lesions during exam
High accuracy for lesions greater than 6mm (>90%)	More sensitive for lesions 5mm and smaller, and flat lesions.
Radiation exposure	Higher risk of perforation

Virtual Colonoscopy

Tube view

3-D view

Filet View



Debate over CMS coverage

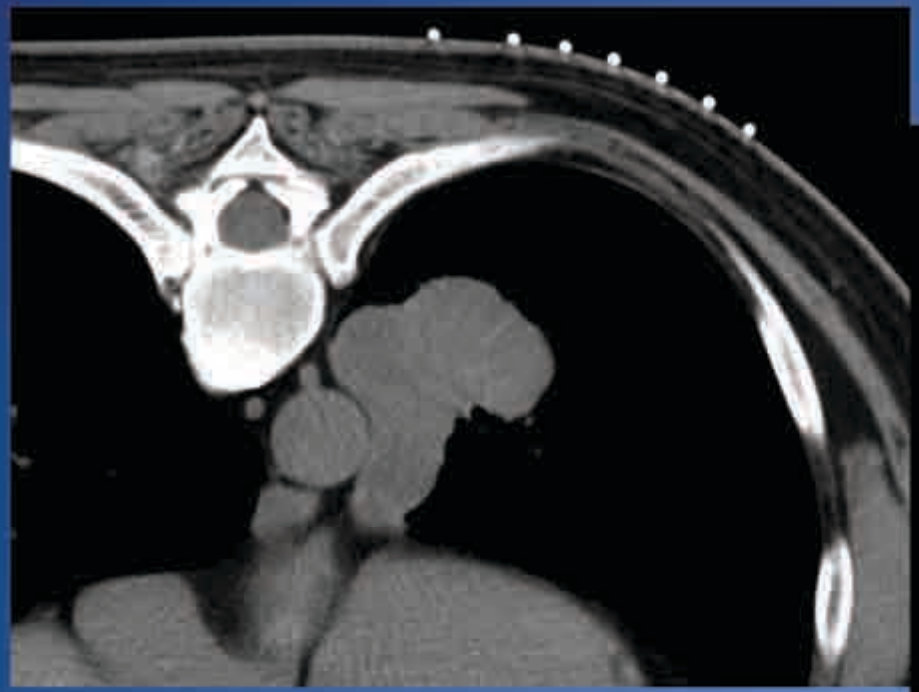
The "pivotal, overarching concern" in [CMS's] decision was the fact that the findings of trials showing a benefit of screening with this method were not necessarily generalizable from the study populations to other groups of patients.

Data that are specific to a population over the age of 65 years exist and show that CT colonography is clinically effective and cost-effective for this population subgroup.

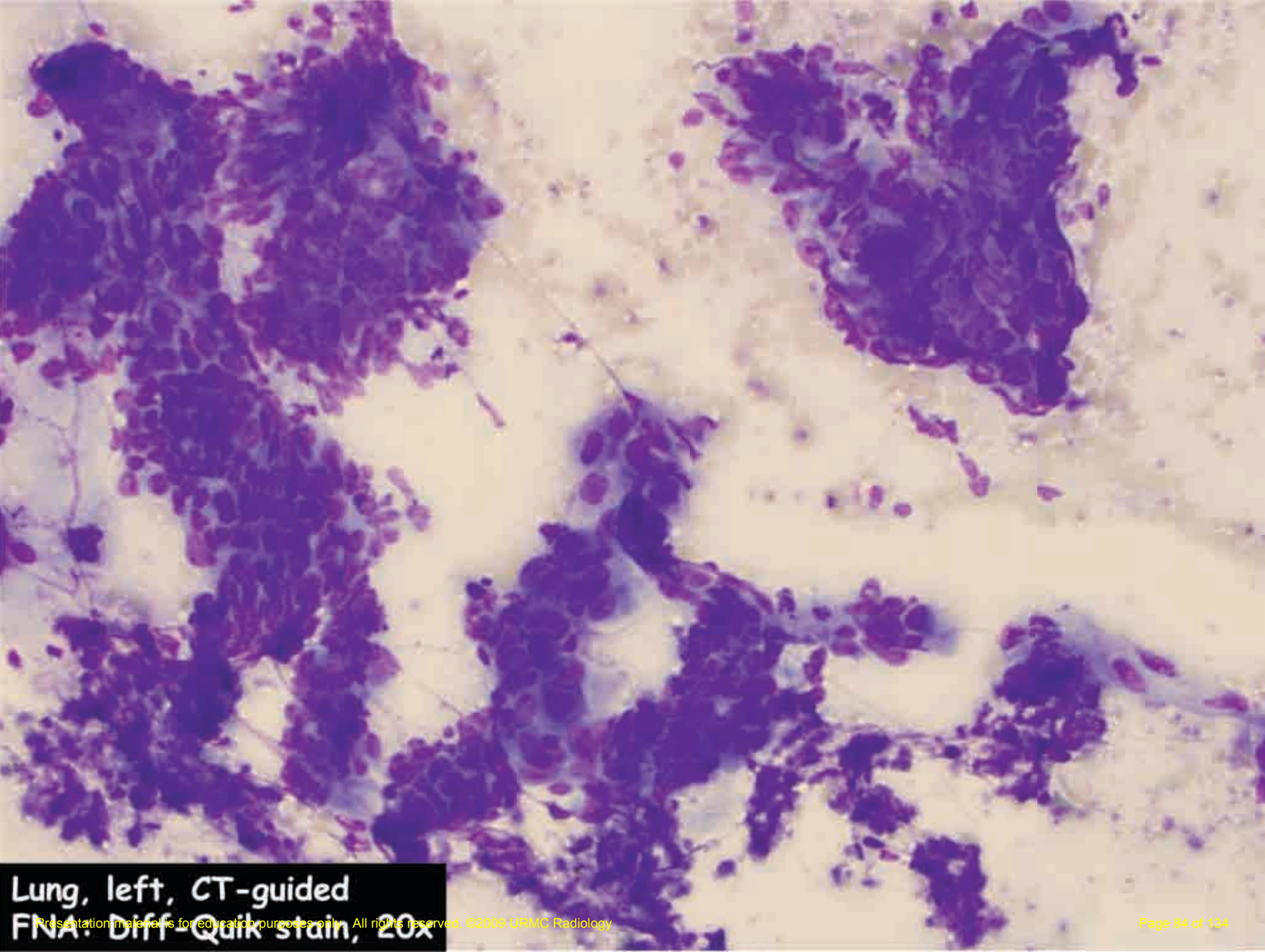
Debate over CMS coverage

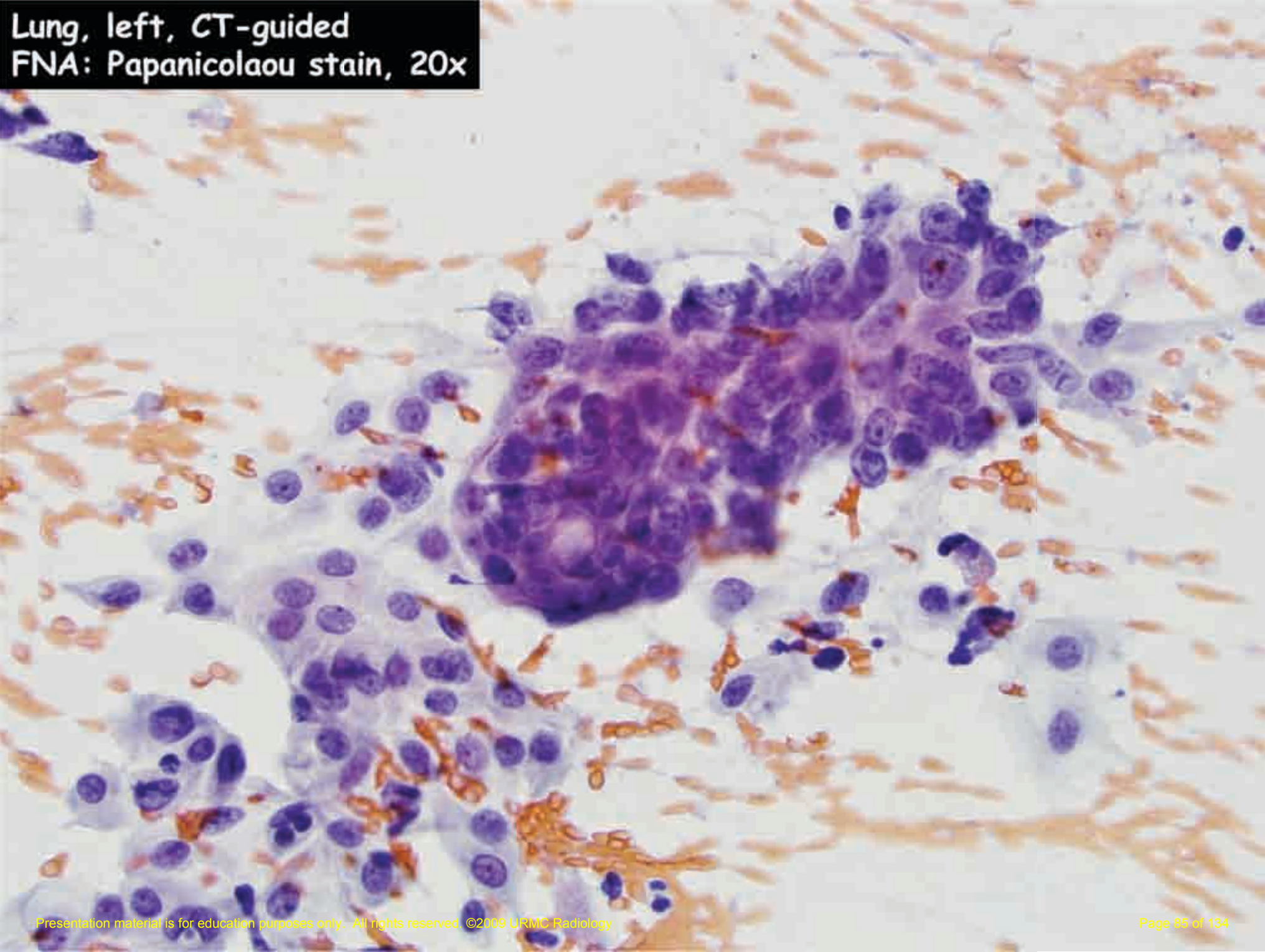
CT colonography does not guarantee increased screening rates.

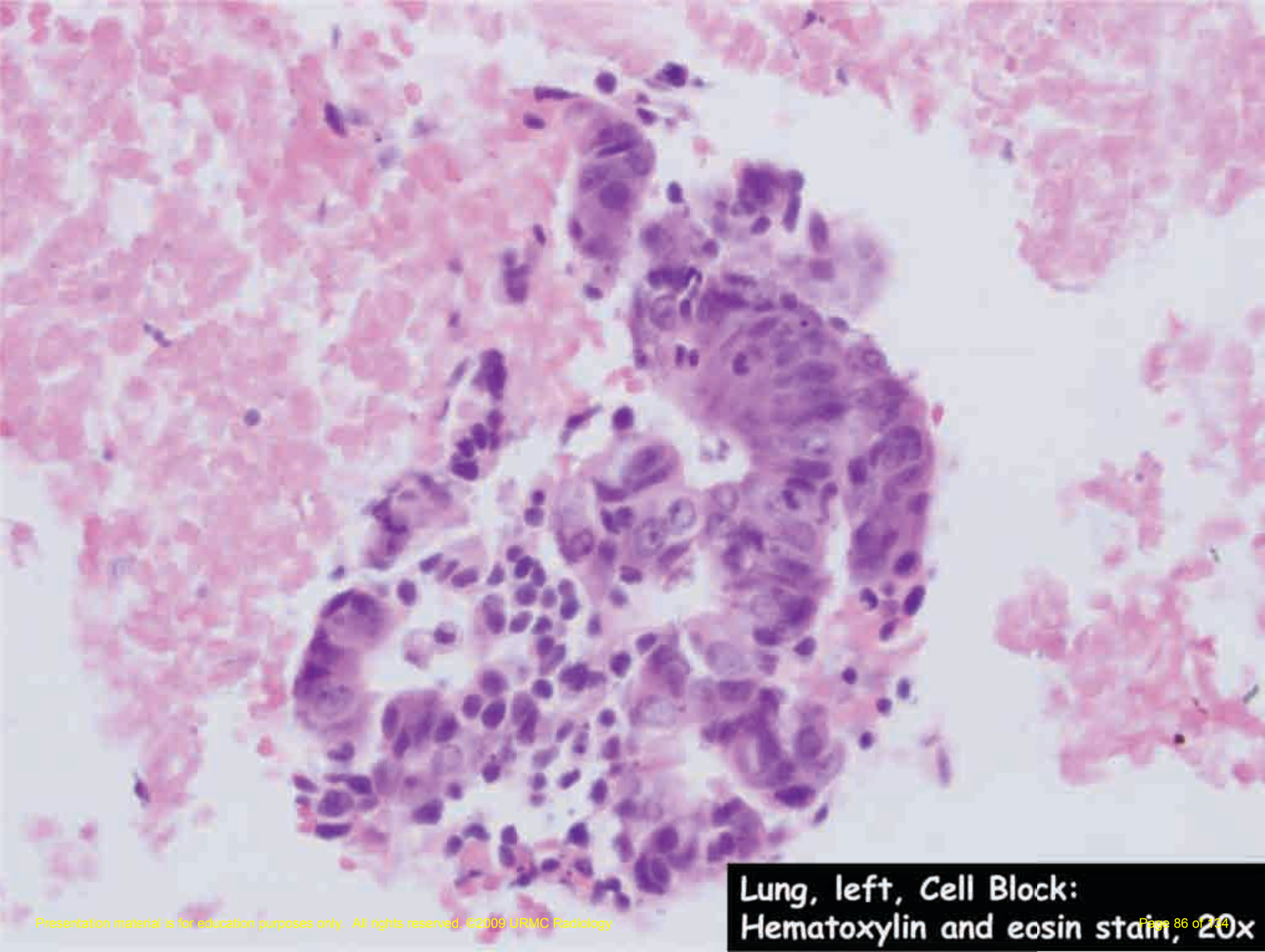
The National Naval Medical Center has seen a 70% increase in colon screening since CT colonography was offered as an option.



Case 3







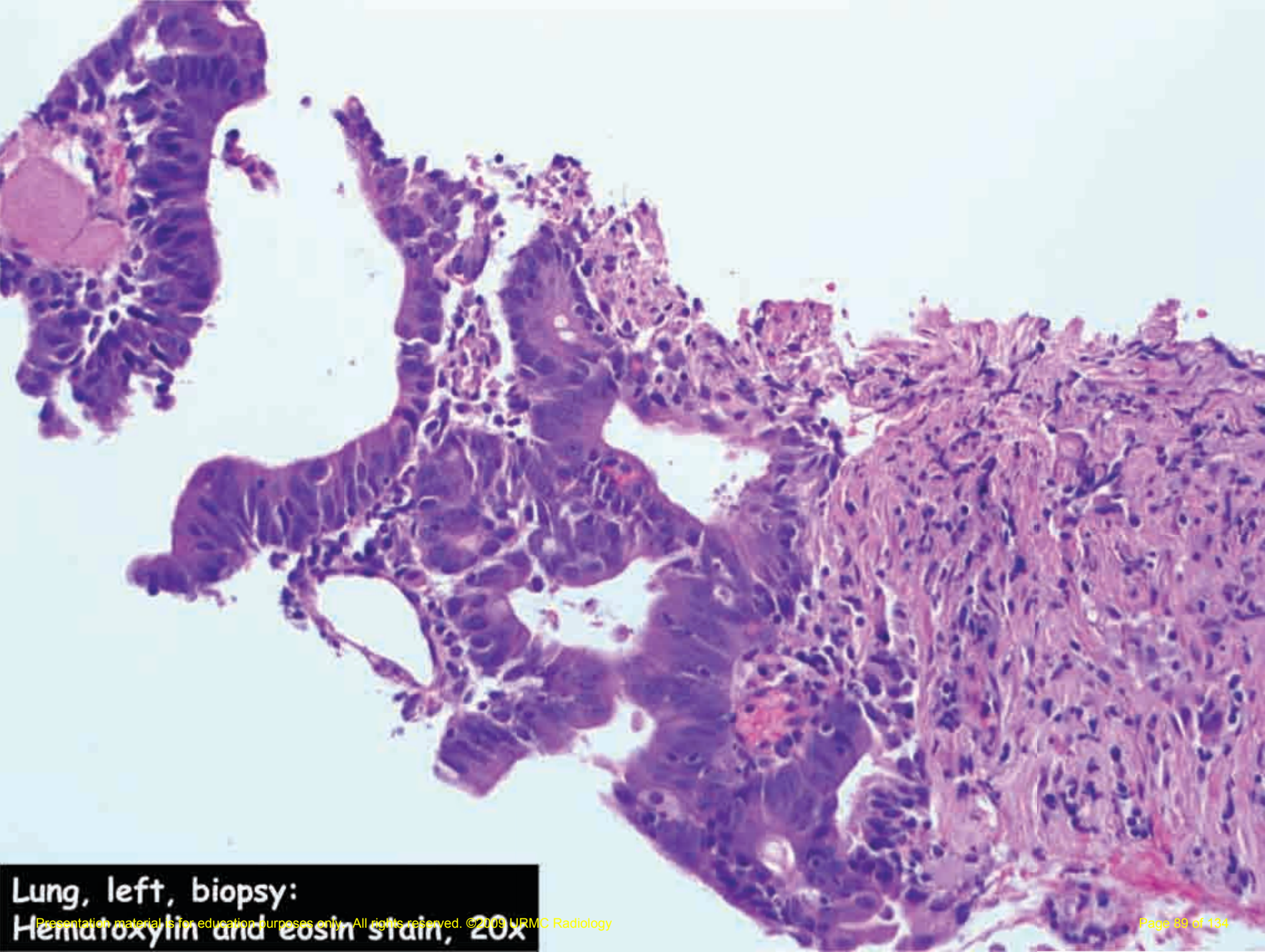
Lung, left, Cell Block:
Hematoxylin and eosin stain, 20x

Lung, left, CT-guided fine needle aspiration:

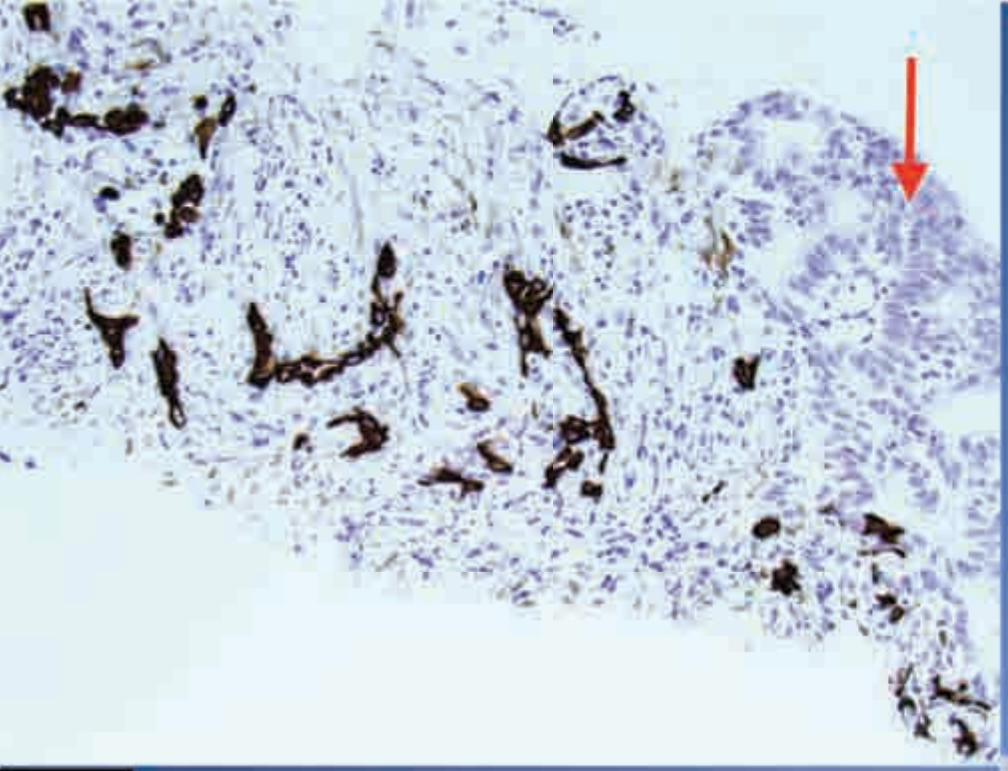
Malignant tumor cells present derived from adenocarcinoma

Lung, left mass, biopsy:

Metastatic colonic adenocarcinoma.

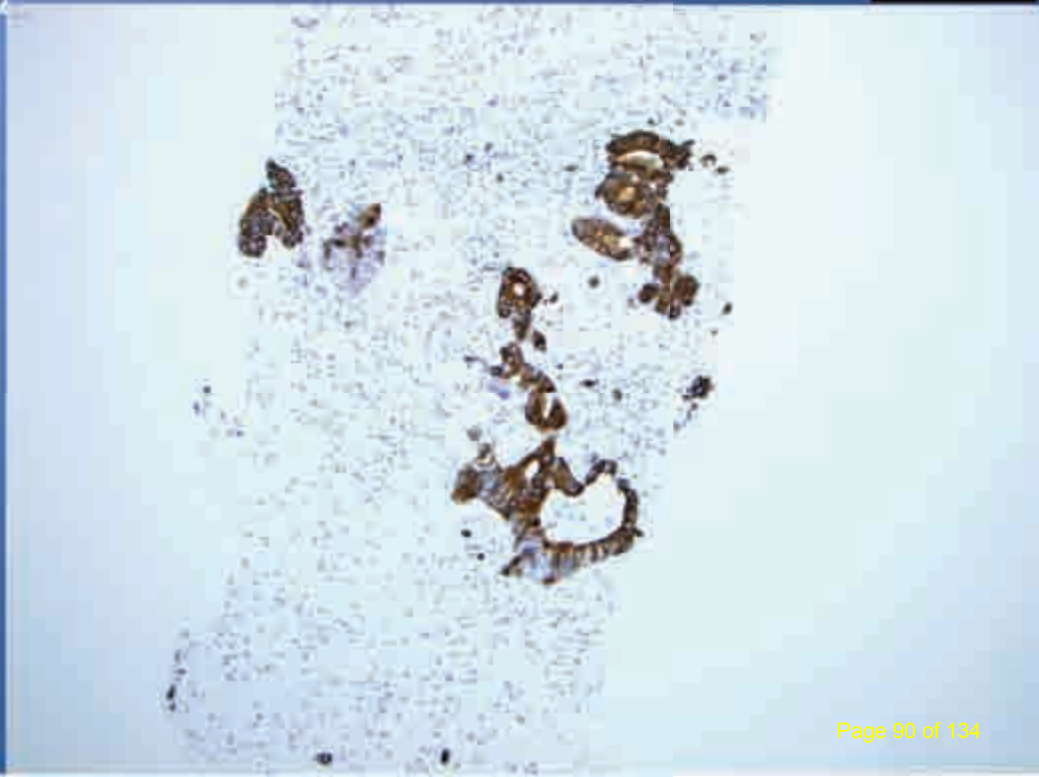


Lung, left, biopsy, IHC:

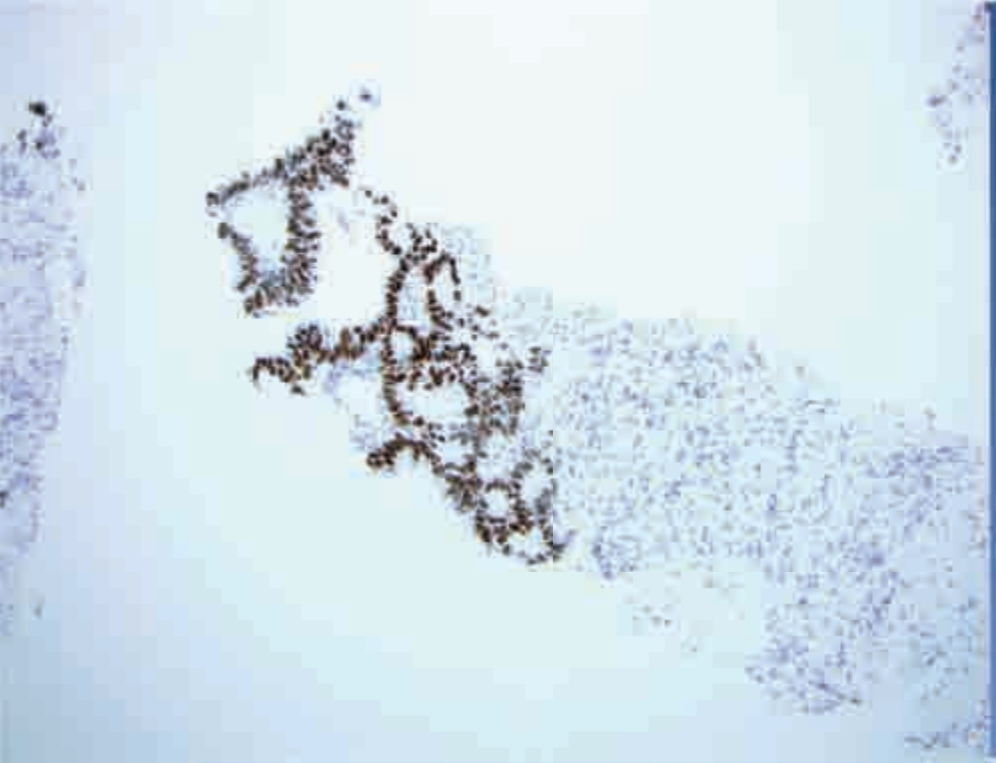


CK20

CK7



Lung, left, biopsy, IHC:

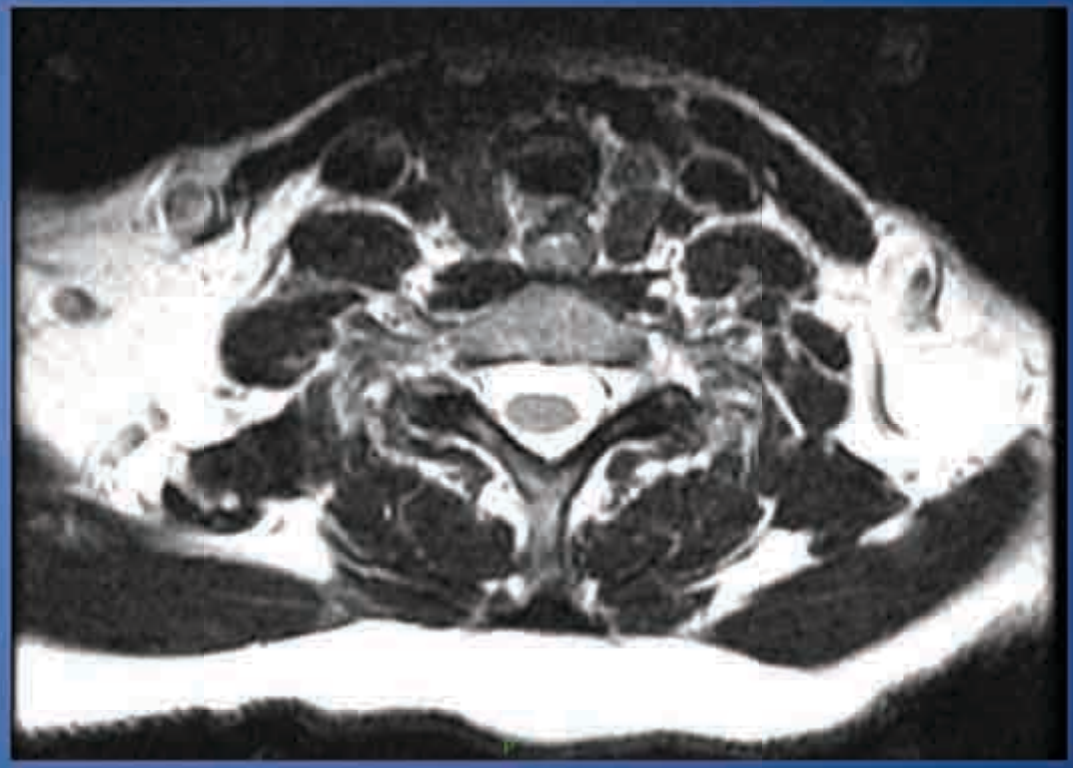


TTF1

CDX2

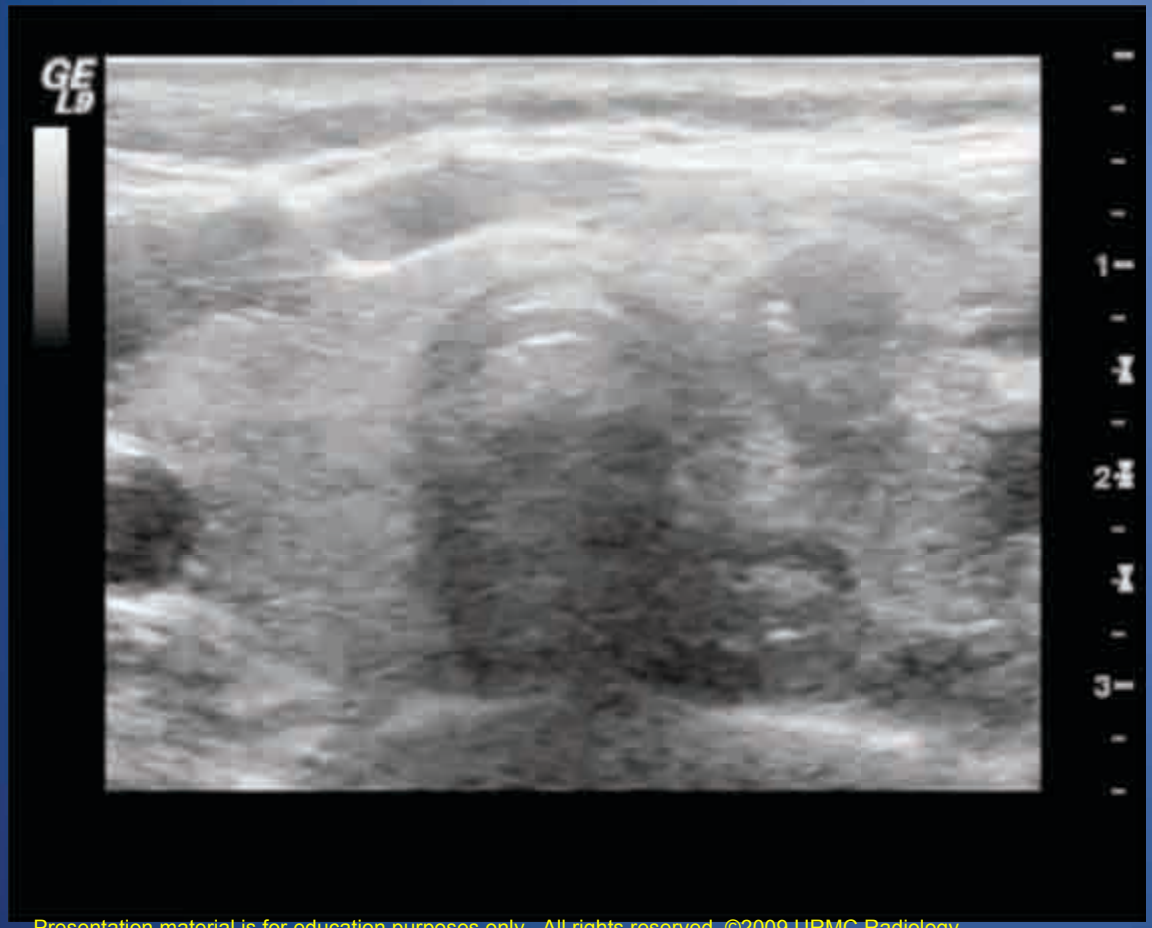
Case 4

Neck Pain (March 2009)

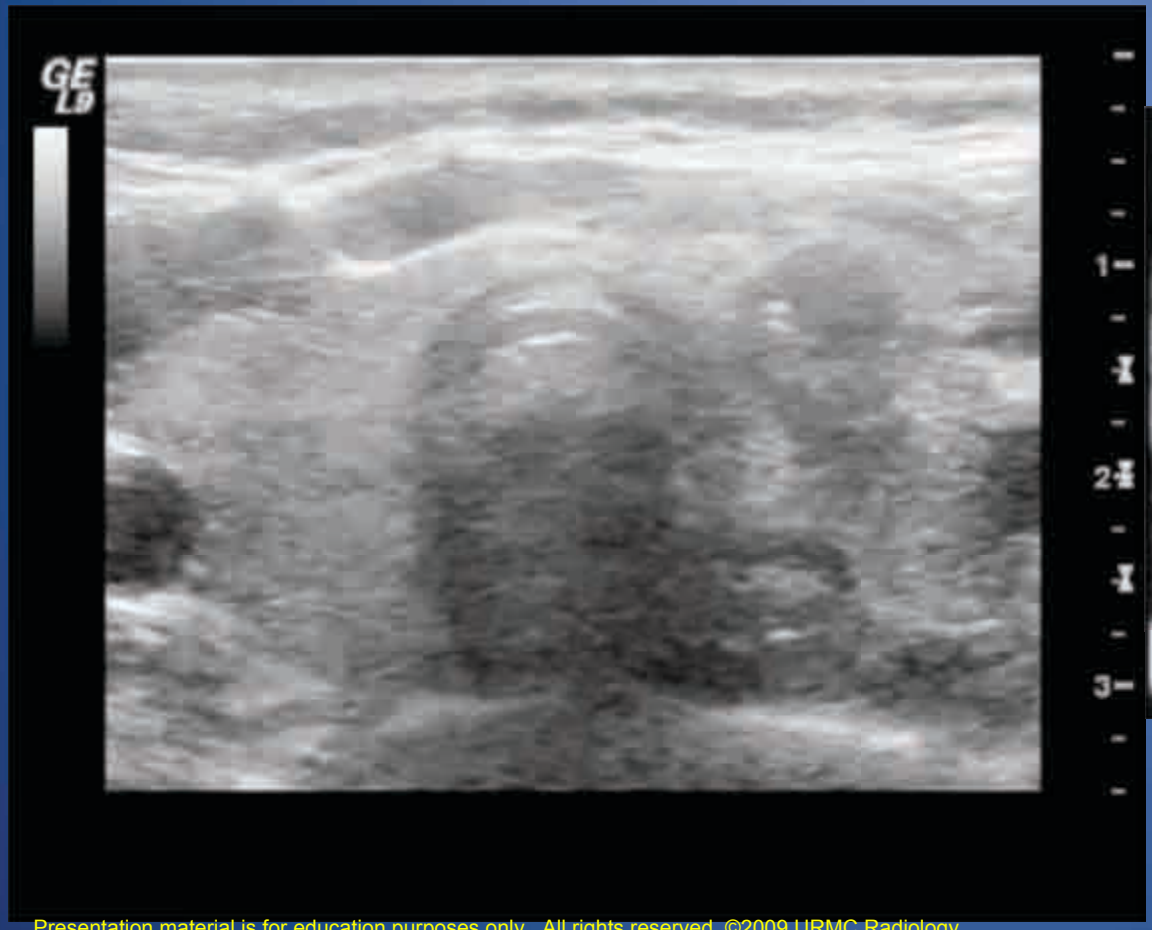


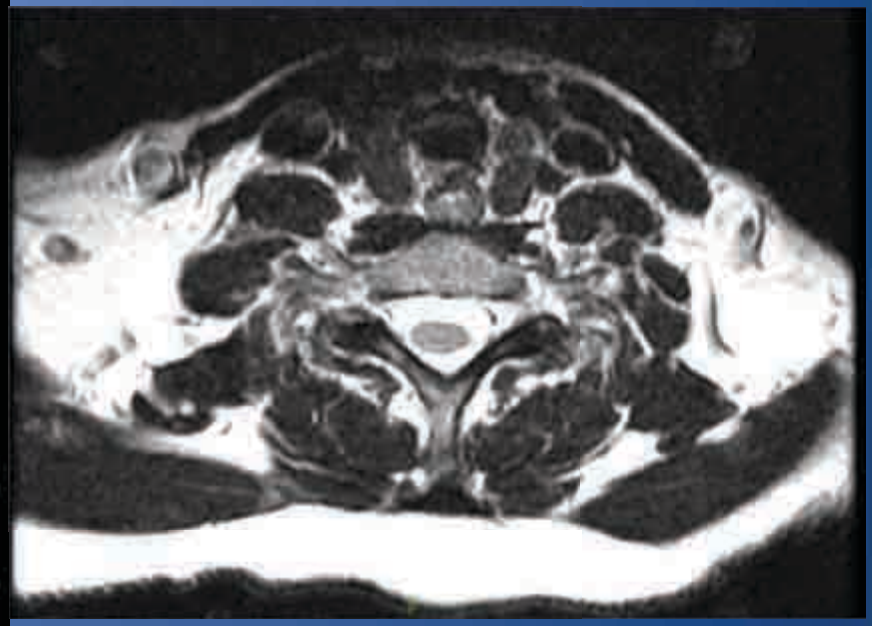
Presents with palpable thyroid mass in Sept 2009

Presents with palpable thyroid mass in Sept 2009

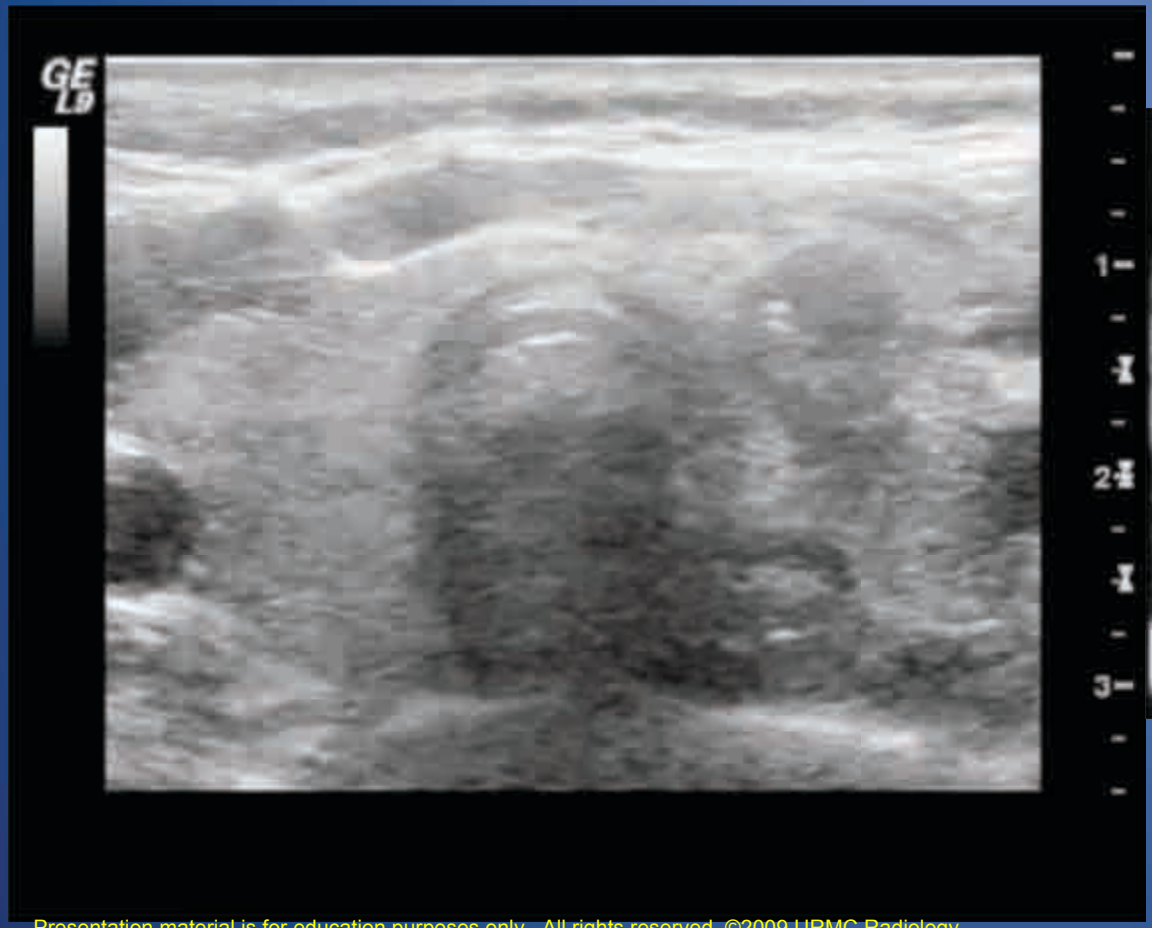


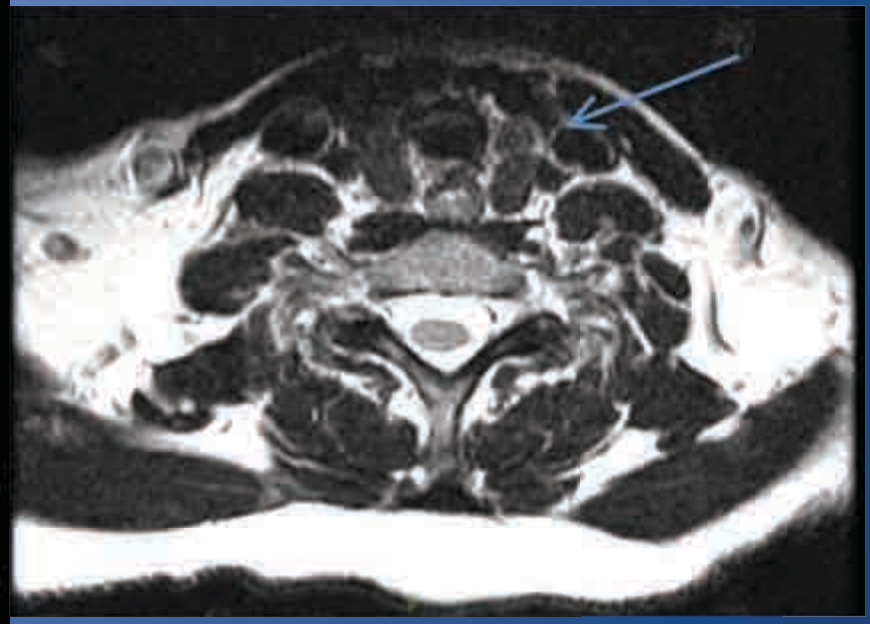
Presents with palpable thyroid mass in Sept 2009





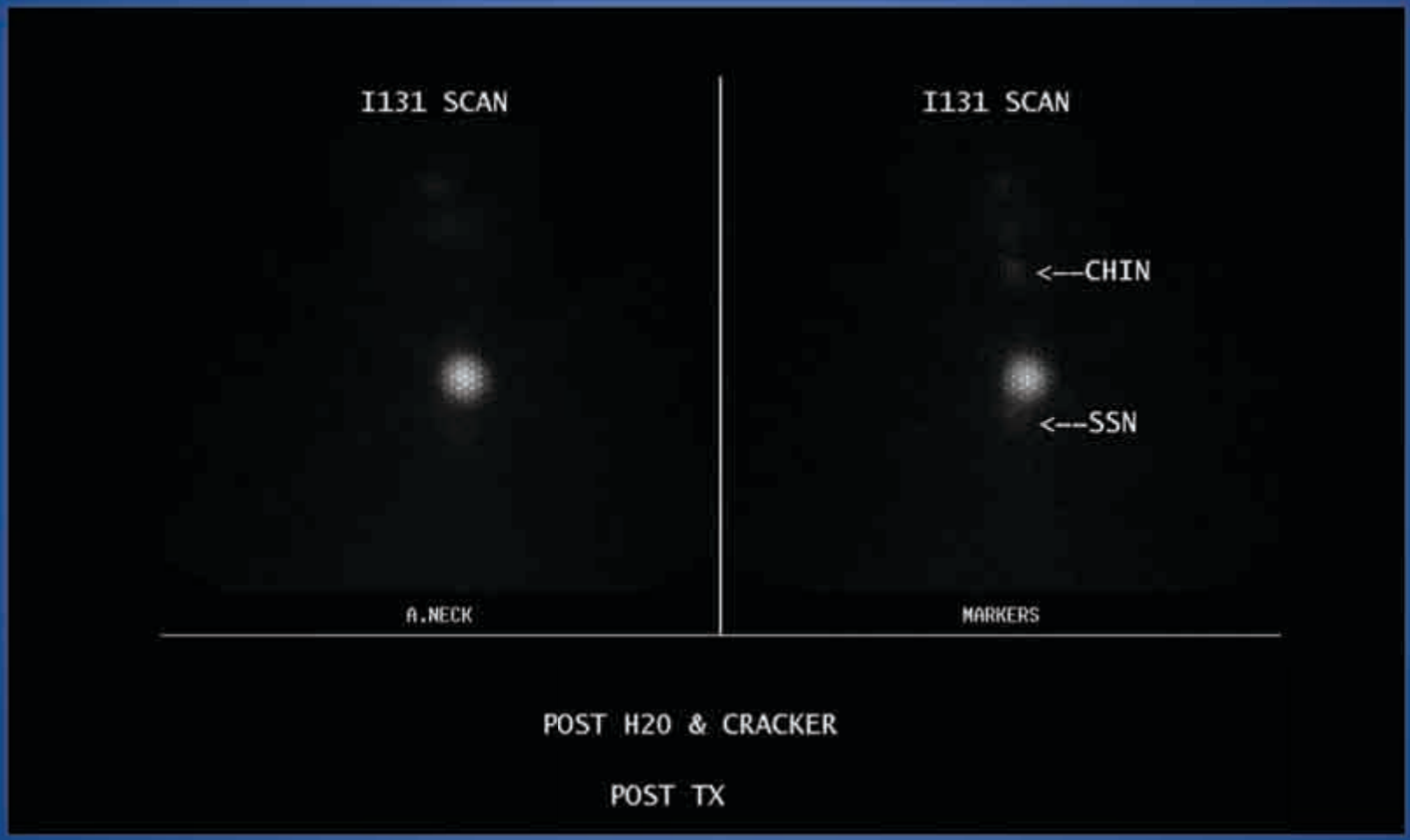
Presents with palpable thyroid mass in Sept 2009





Post Thyroidectomy Scan

Post Thyroidectomy Scan



Outpatient Treatment of Residual Thyroid Tissue

Radiopharmacutical: I-131

If the patient receives over 33 mCi, they can still be treated as an outpatient if:

Sleep alone
Refrain from using mass transit
Sole use of a bathroom – flush twice.
Maintain distance from others
Disposable silverware and dishes

Outpatient Treatment of Residual Thyroid Tissue

Radiopharmacutical: I-131

If the patient receives over 33 mCi, they can still be treated as an outpatient if:

Sleep alone
Refrain from using mass transit
Sole use of a bathroom – flush twice.
Maintain distance from others
Disposable silverware and dishes

Maximum Dosage is ~220 mCi

Physics Boards Questions

Don't get pregnant for 12 months

Stop breastfeeding indefinitely

I – 131 is a fission product of Uranium

Half life is 8 days

Other considerations

Each patient is given proof of I-131 administration for doses over 7 mCi.

3 Months after treatment, patients can still set off radiation counters in airports and security checkpoints.

In March 2003, a bus traveling from New York City to Atlantic City set off a radiation alarm in a tunnel as it passed by a radiation detector. When the State Police stopped the bus, it was discovered that one of the passengers had received 370 MBq I-131 [two days ago] and did not follow directions to avoid public transportation

25 days after treatment with 150 MBq of I-131 for toxic, multinodular goiter, a 76-year-old man set off the radiation alarm at Vienna International Airport

In 2005, an Australian businessman traveling to the United States by air, 1 week after receiving a second therapeutic dose of 300 MBq I-131.

[He] was taken aside for detailed questioning by a homeland security attendant.

In 2005, an Australian businessman traveling to the United States by air, 1 week after receiving a second therapeutic dose of 300 MBq I-131.

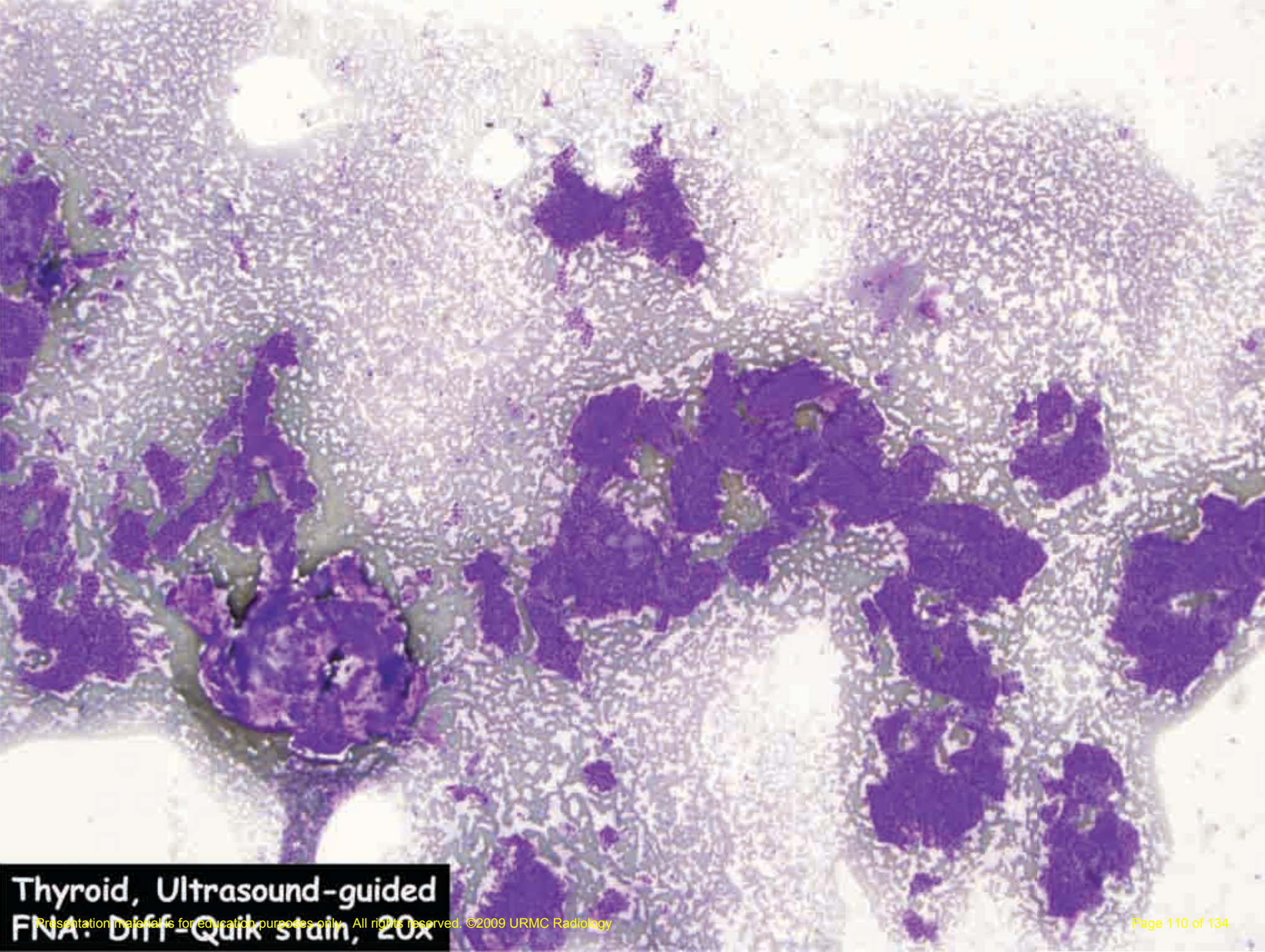
[He] was taken aside for detailed questioning by a homeland security attendant.

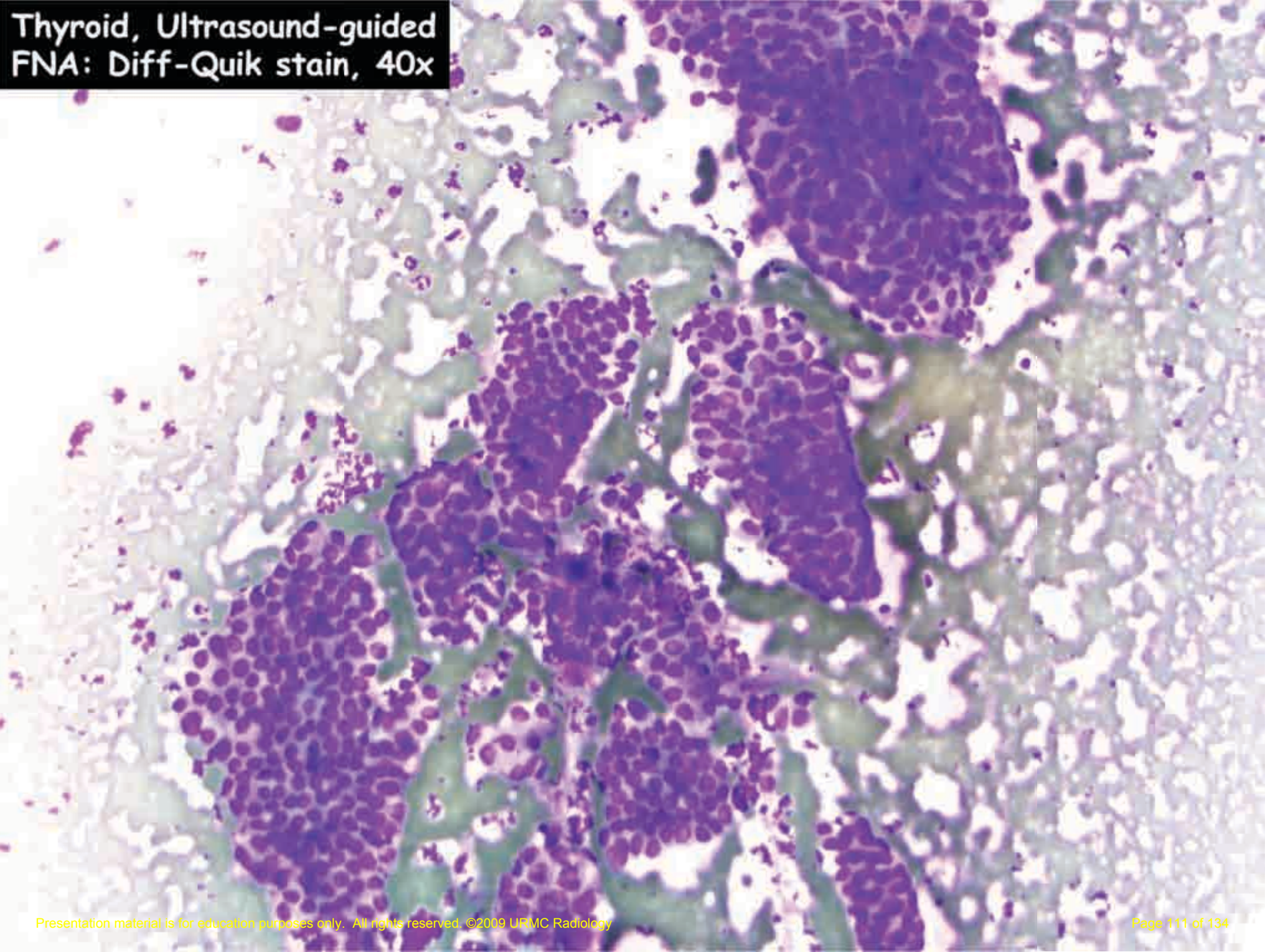
"The episode caused significant distress for the patient."

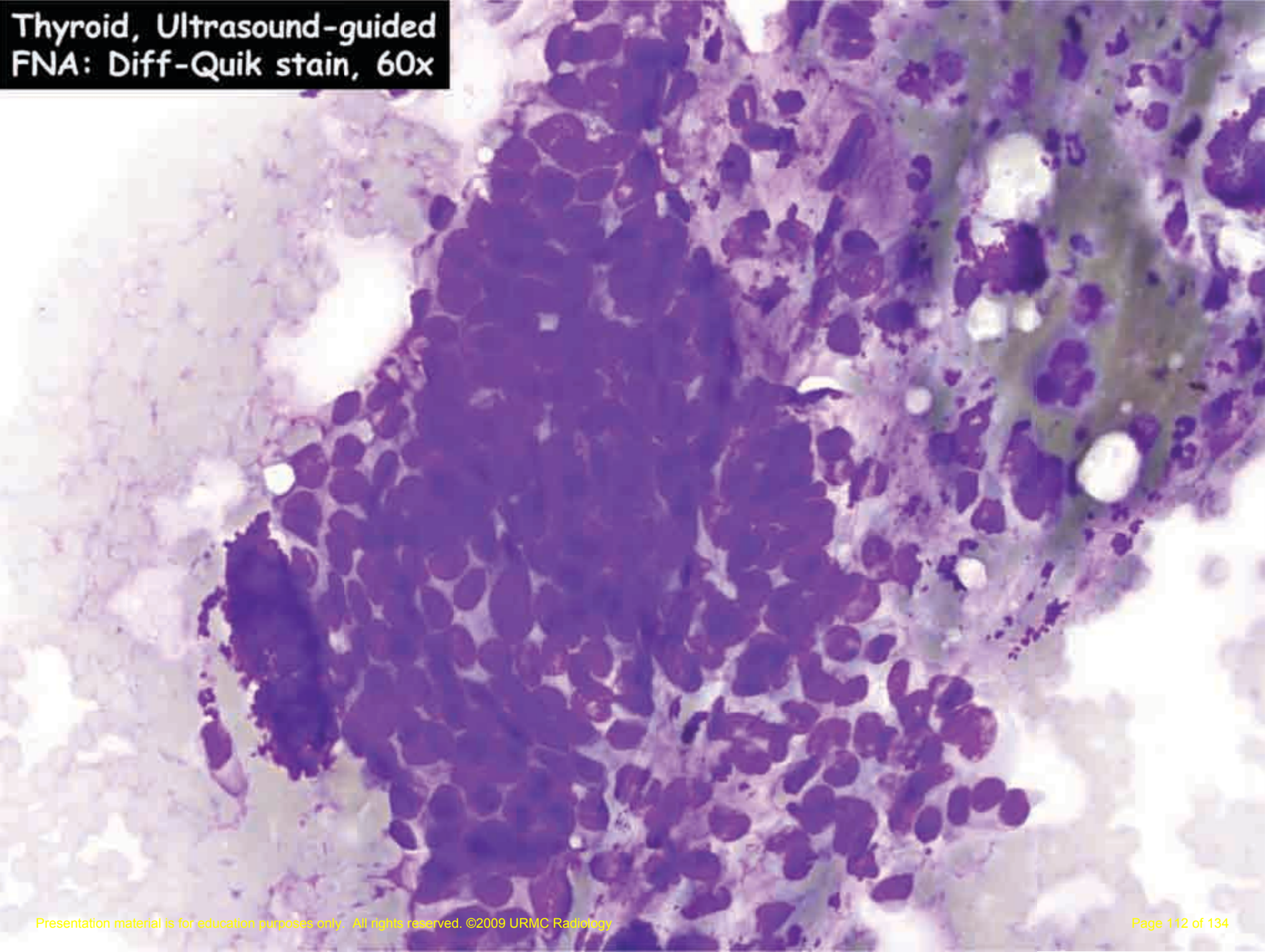
A 59 year old woman and her grandson visited the White House after I-131 treatment.

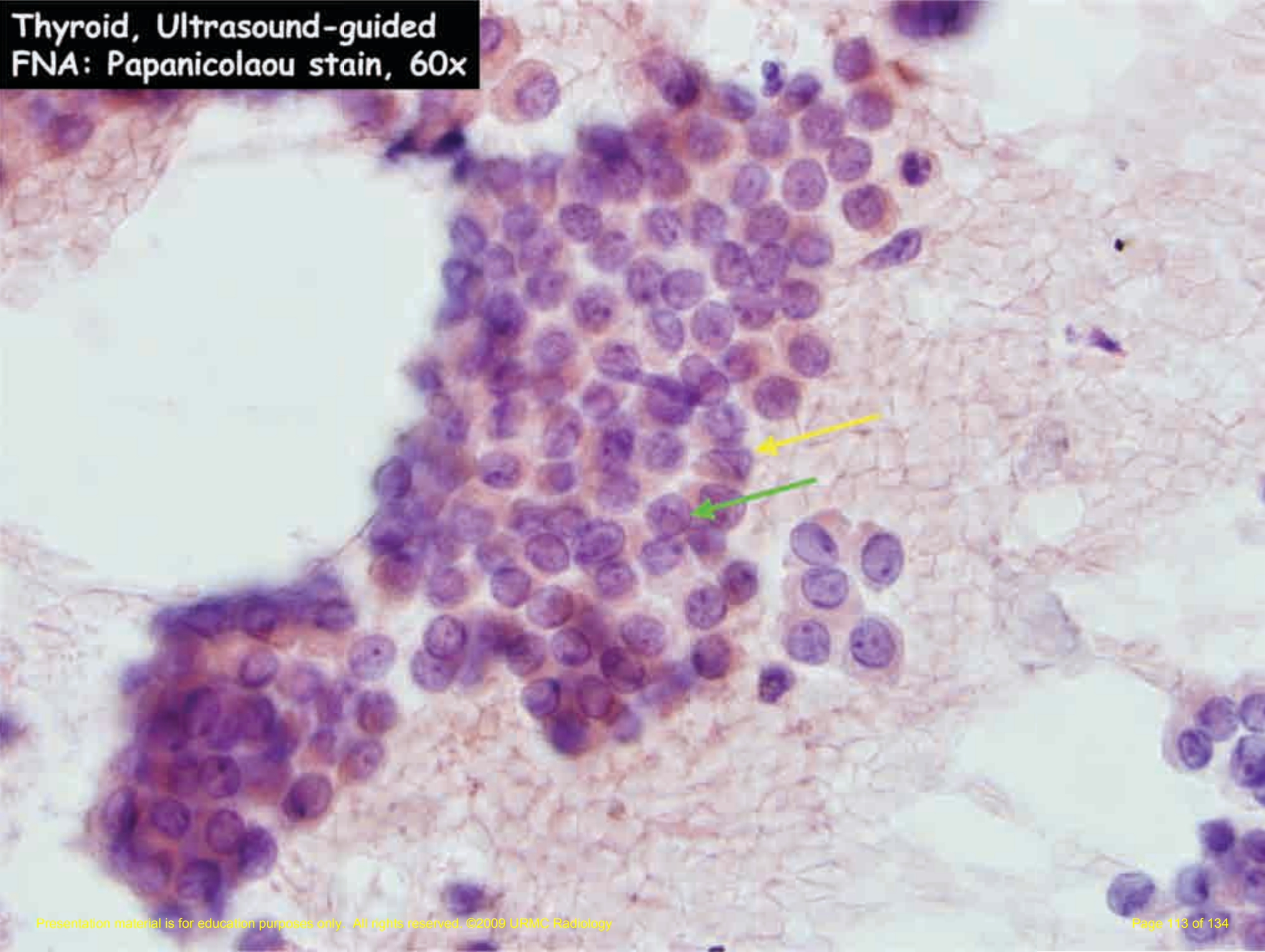
This 5-foot-tall, 149-pound grandmother was immediately surrounded by security personnel with gun holsters opened, and she was informed that she had set off a sensitive radiation-detector device.

Case 4







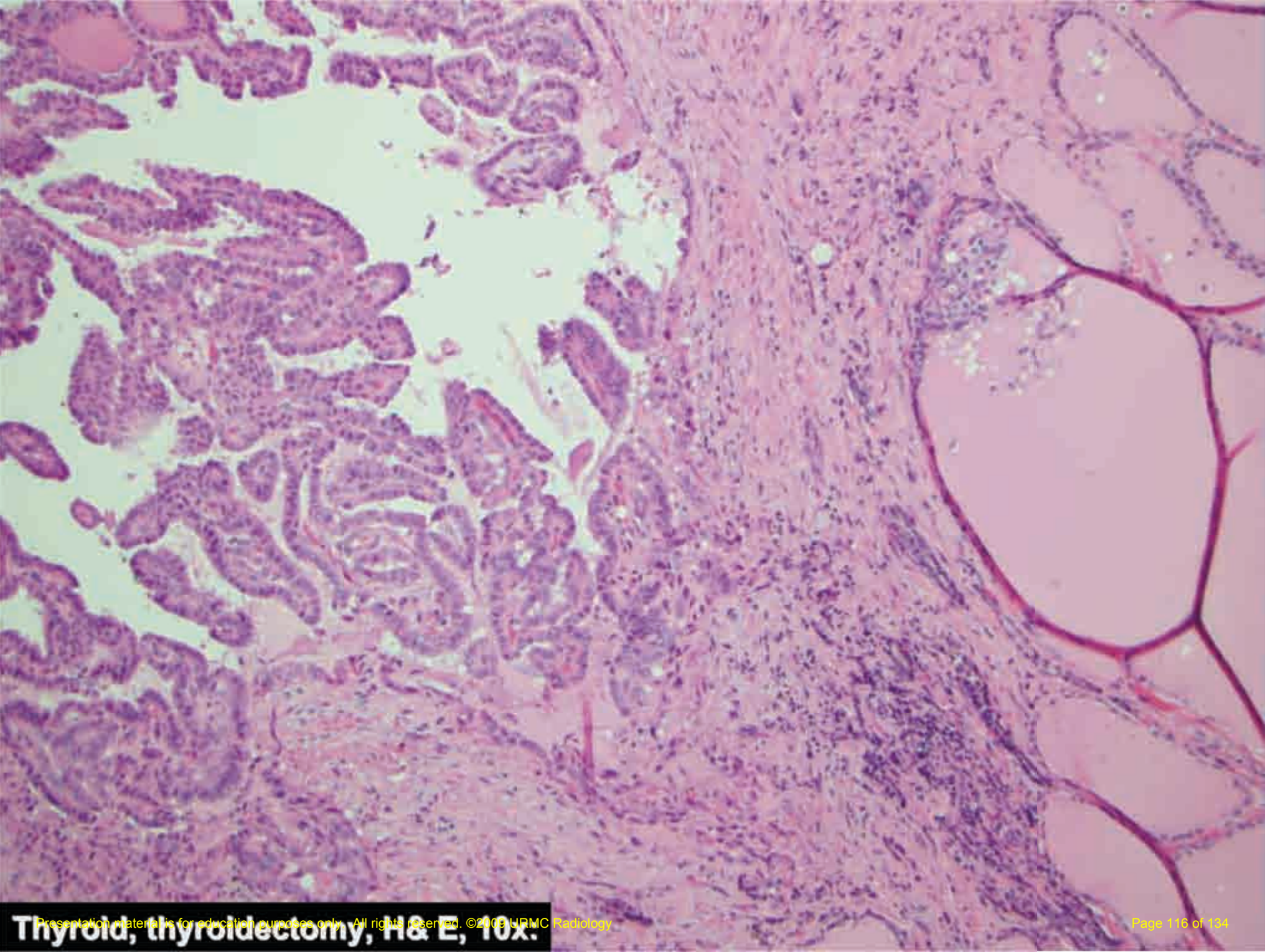


Thyroid, Ultrasound-guided fine needle aspiration:

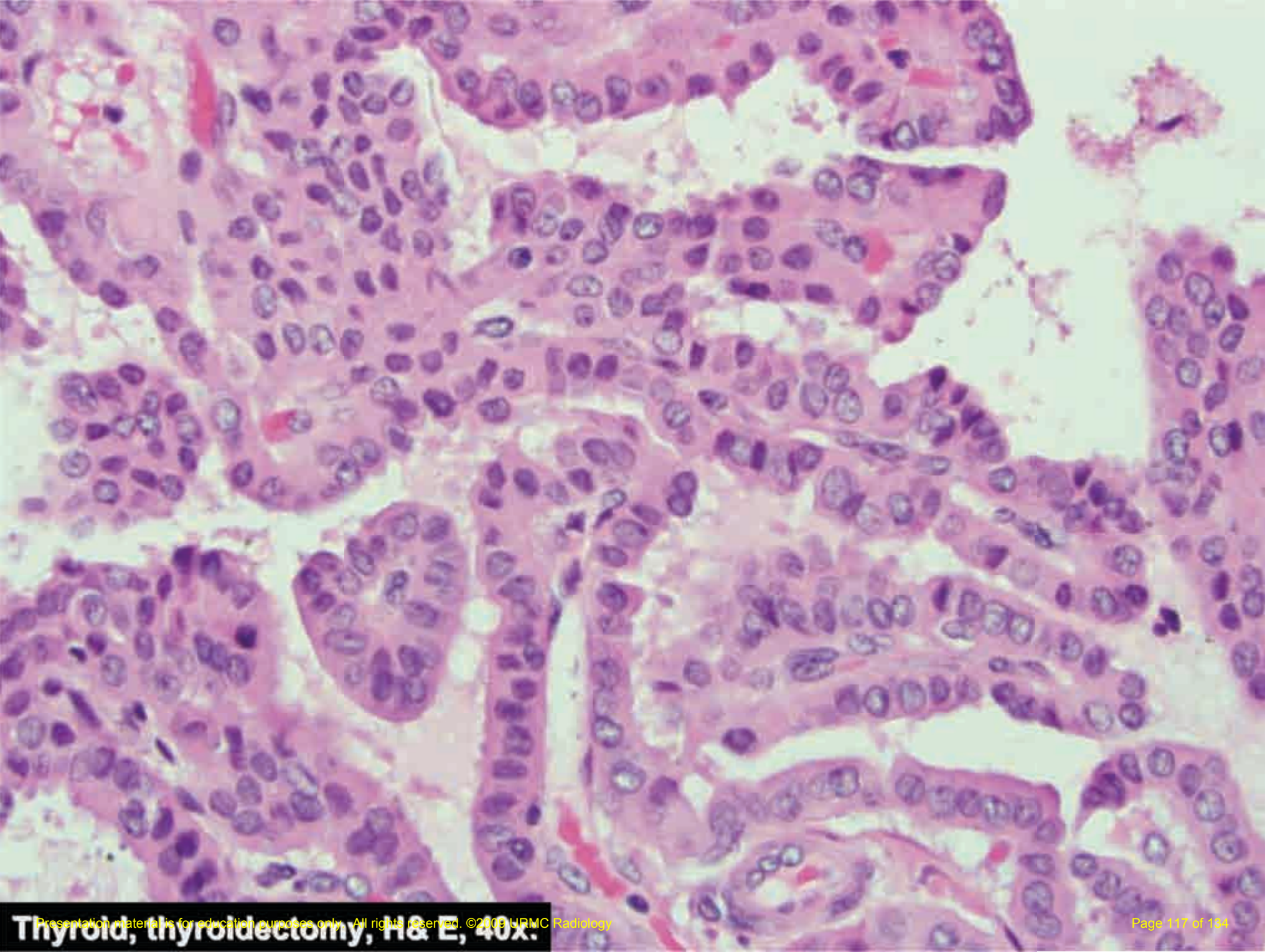
Malignant tumor cells present derived from papillary carcinoma of thyroid.

Thyroid, thyroidectomy:

Papillary carcinoma of the thyroid, classic type, well-differentiated



Thyroid, thyroidectomy, H& E, 10x.

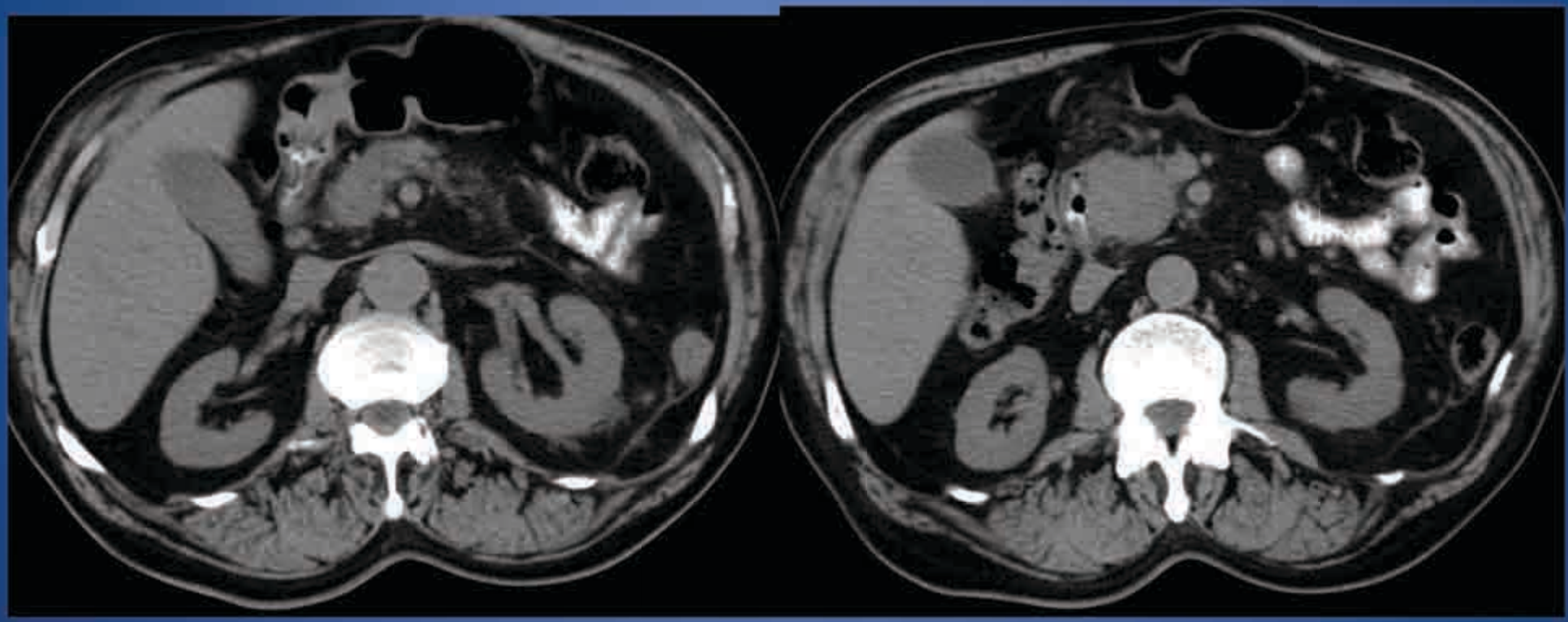


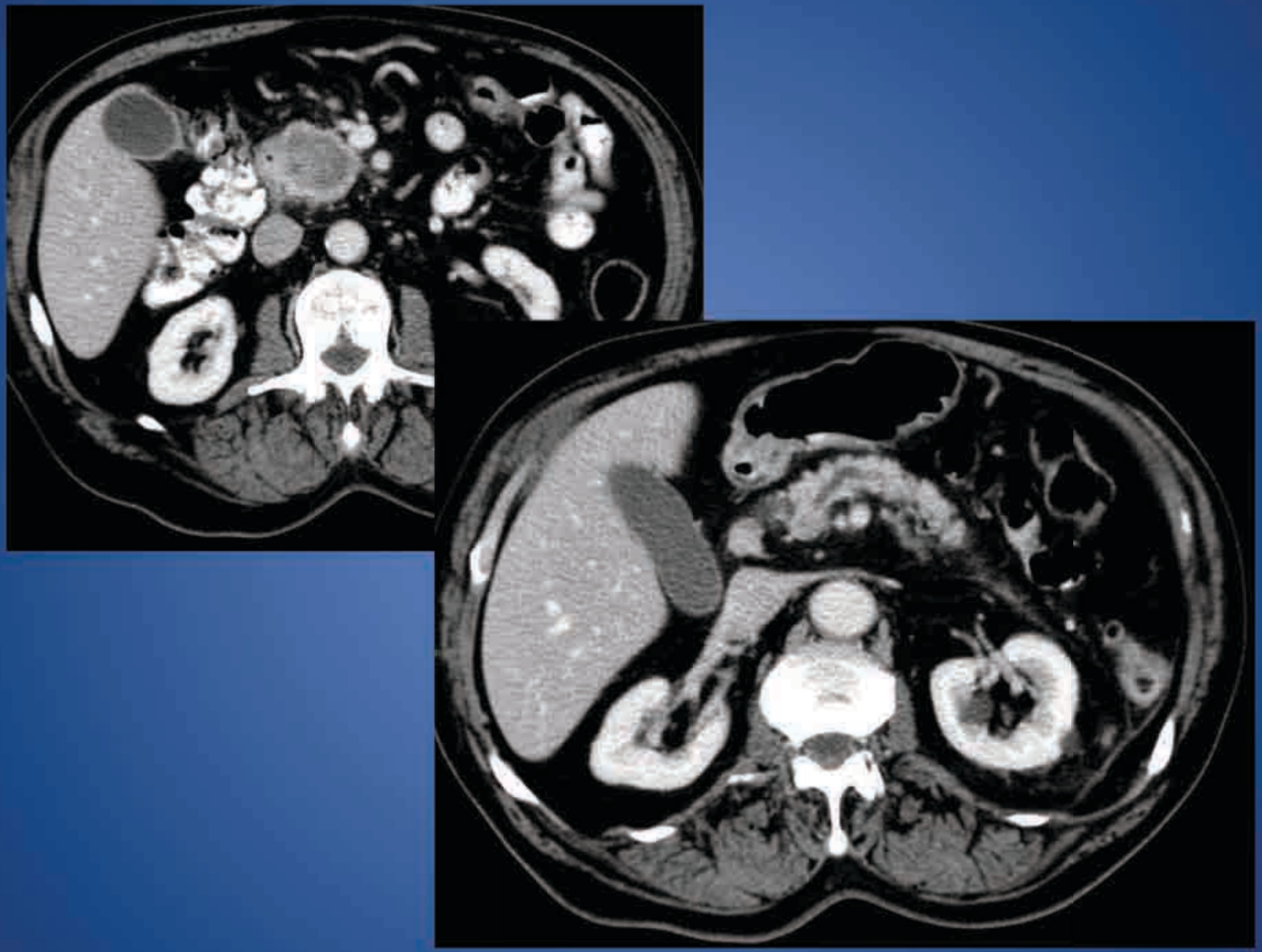
Thyroid, thyroidectomy, H& E, 40x.

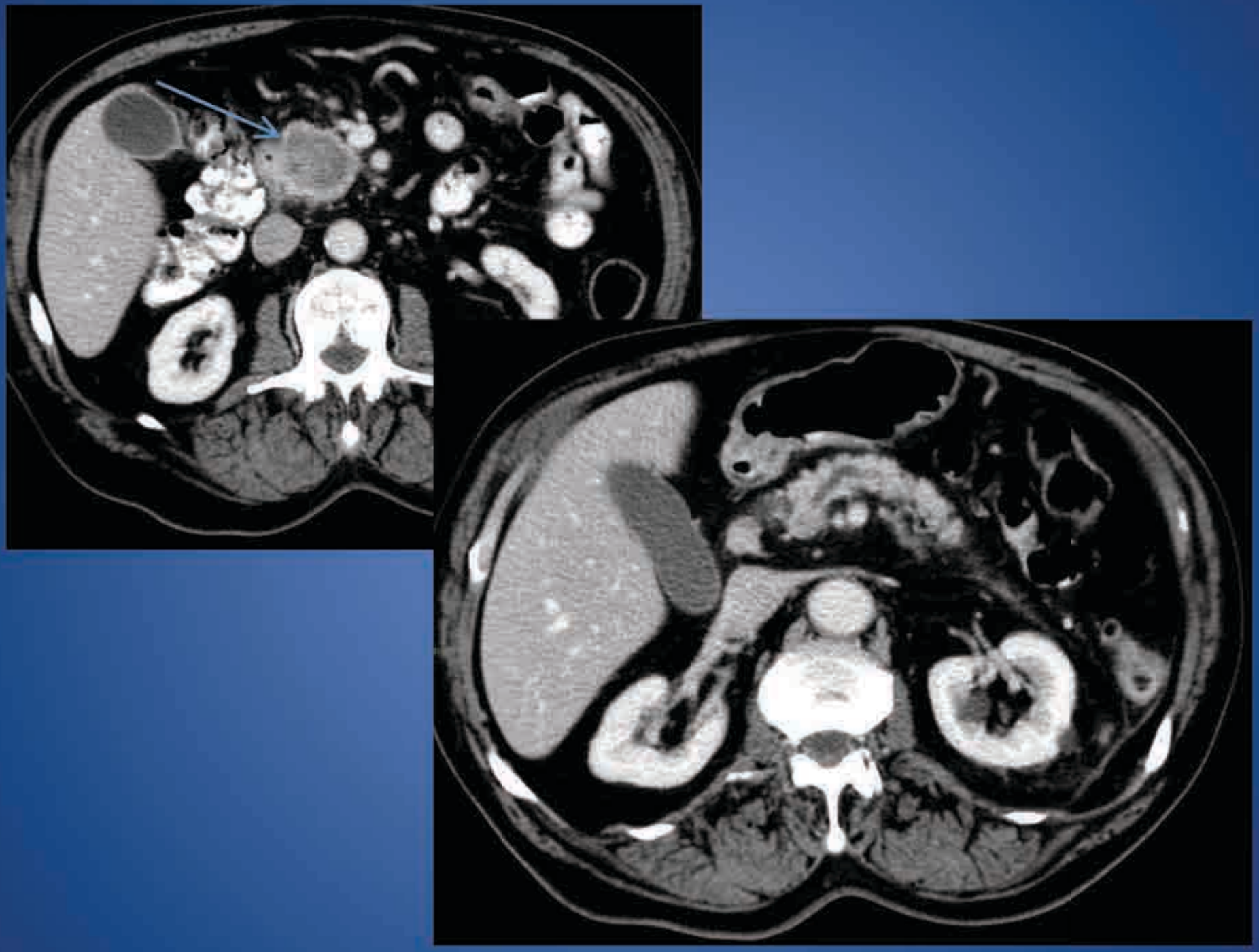
Case 5

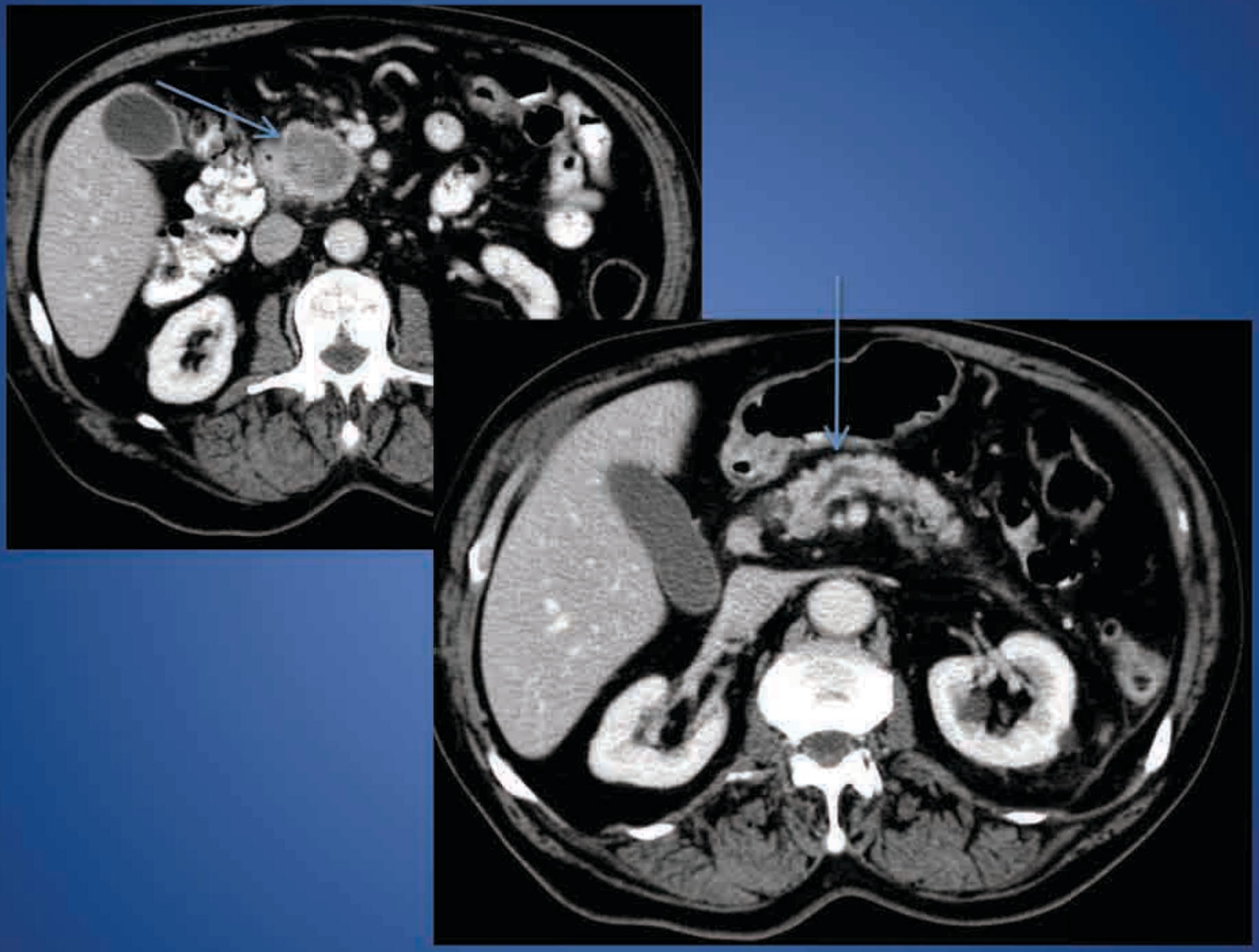
- 78 Year old male with multiple medial problems
- Presents with 2-3 weeks of increased flatus, bloating, constipation, loss of appetite.
- Noticed recent 20-30 pound weight loss.

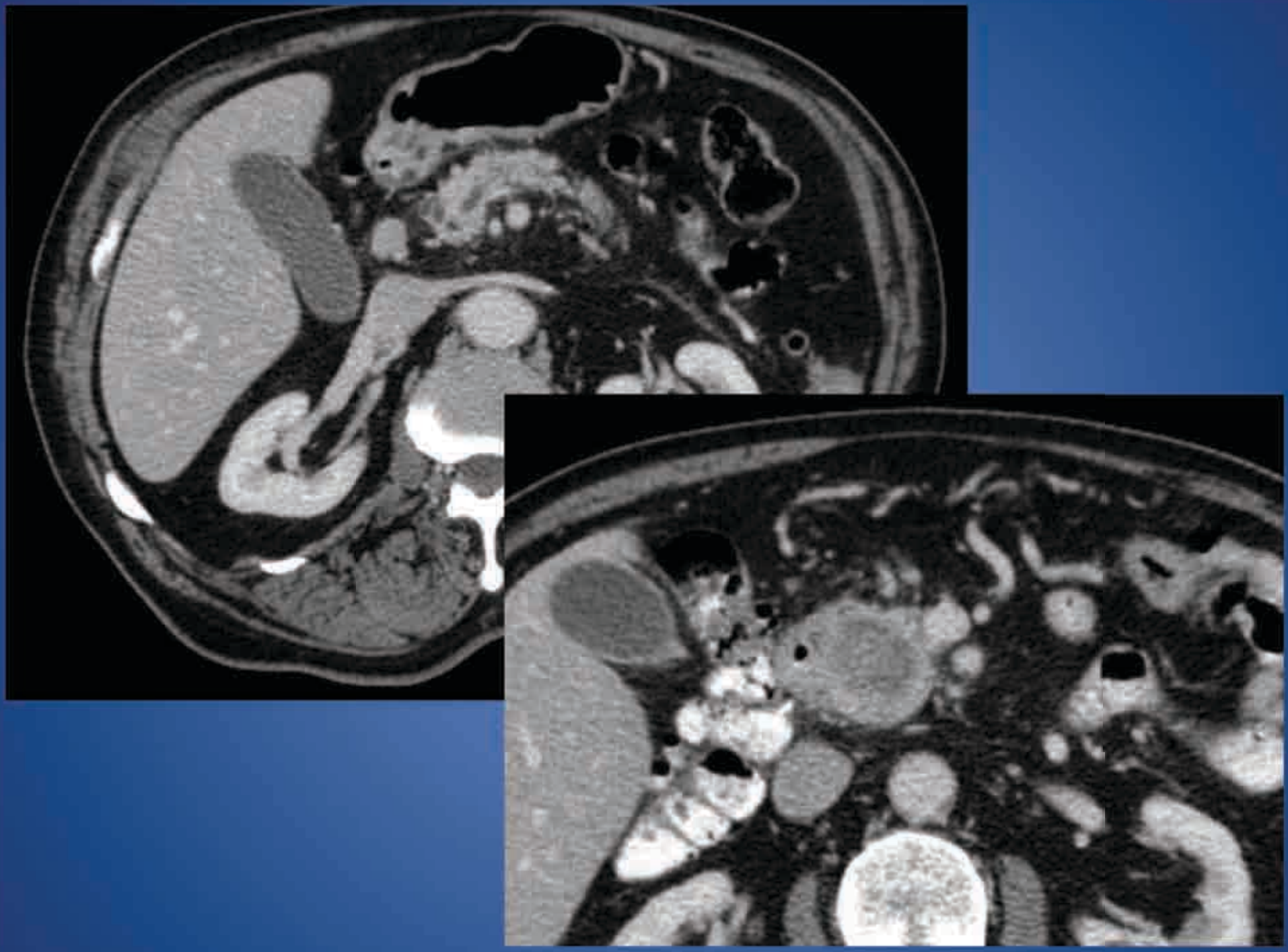
Initial CT (Biphasic)

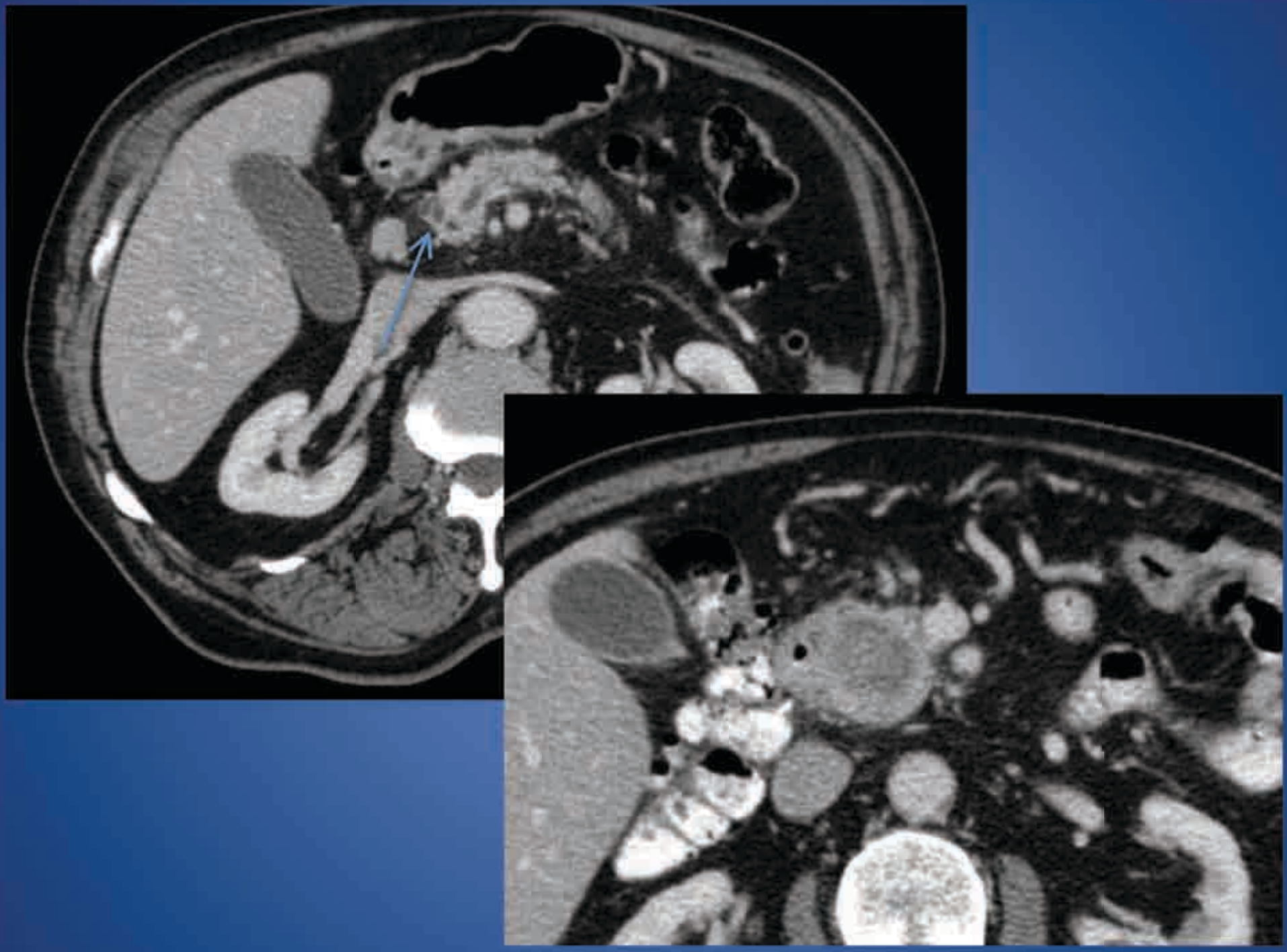


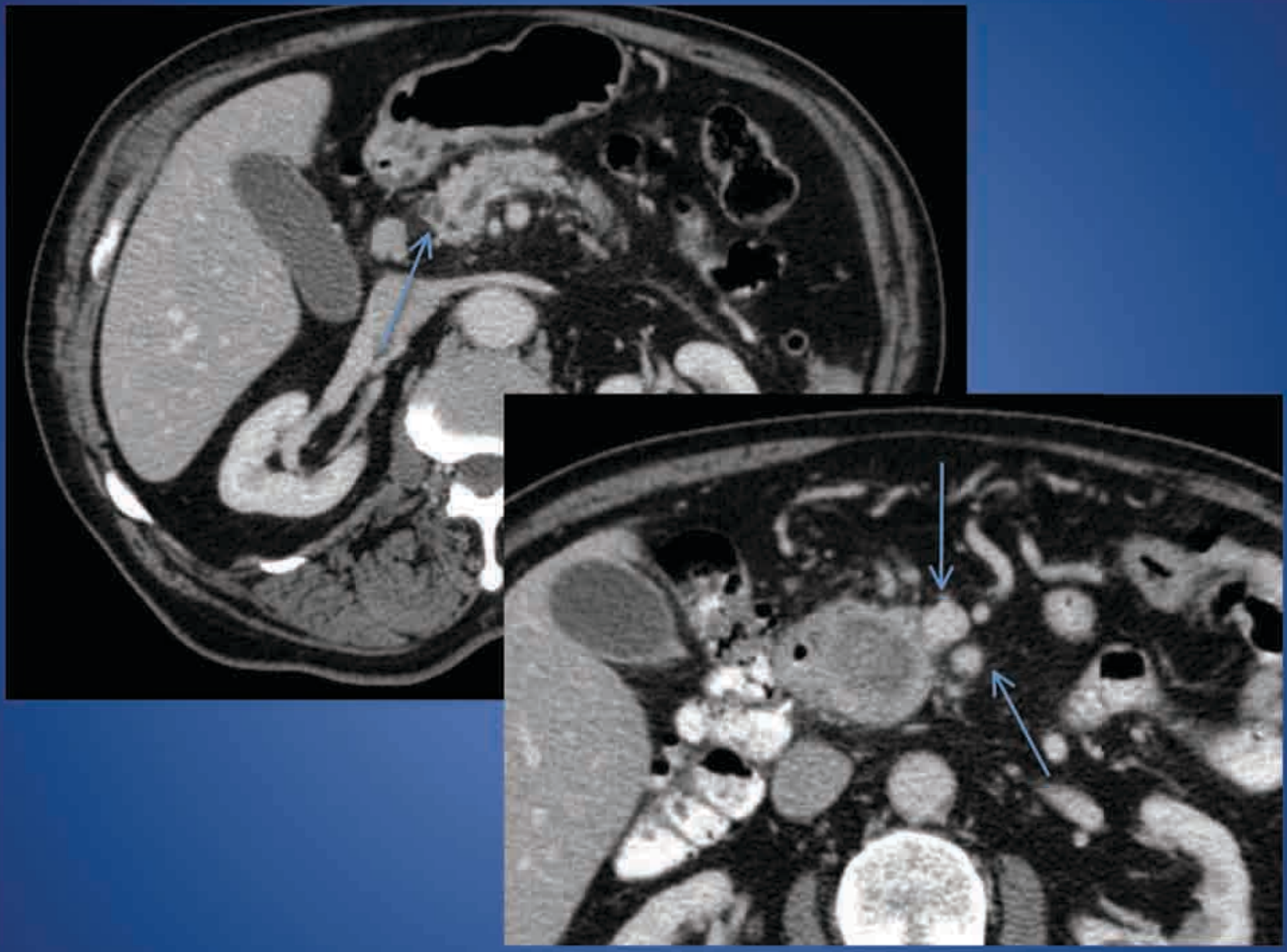


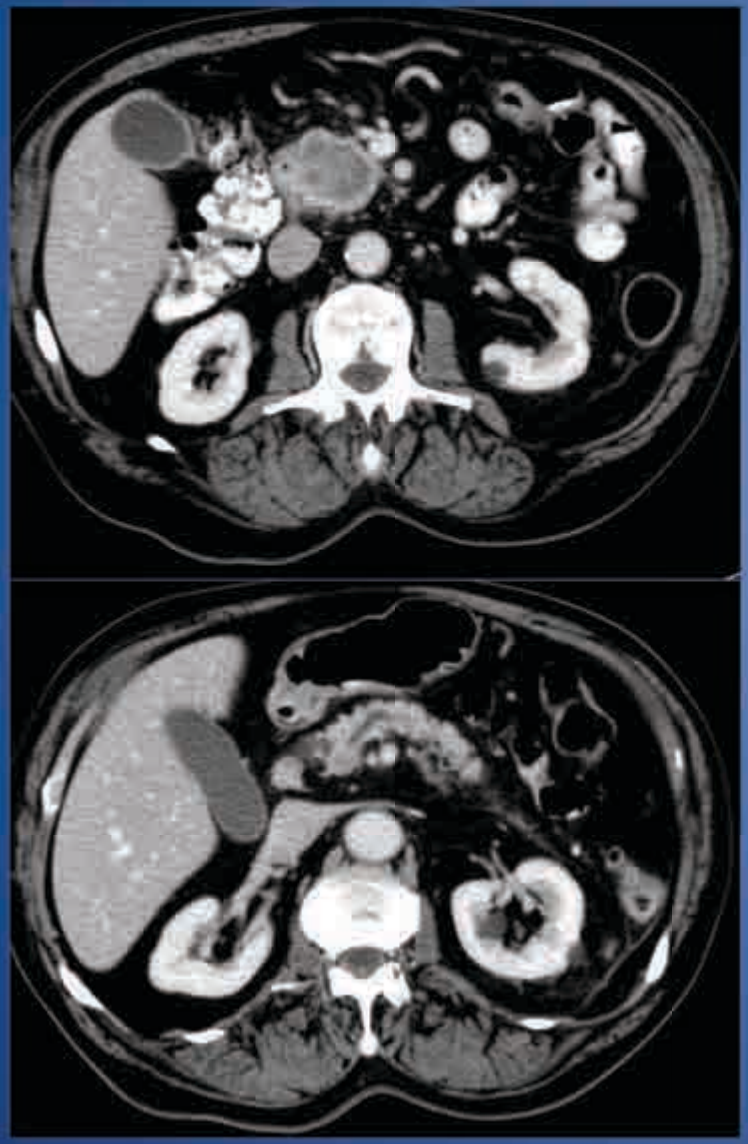


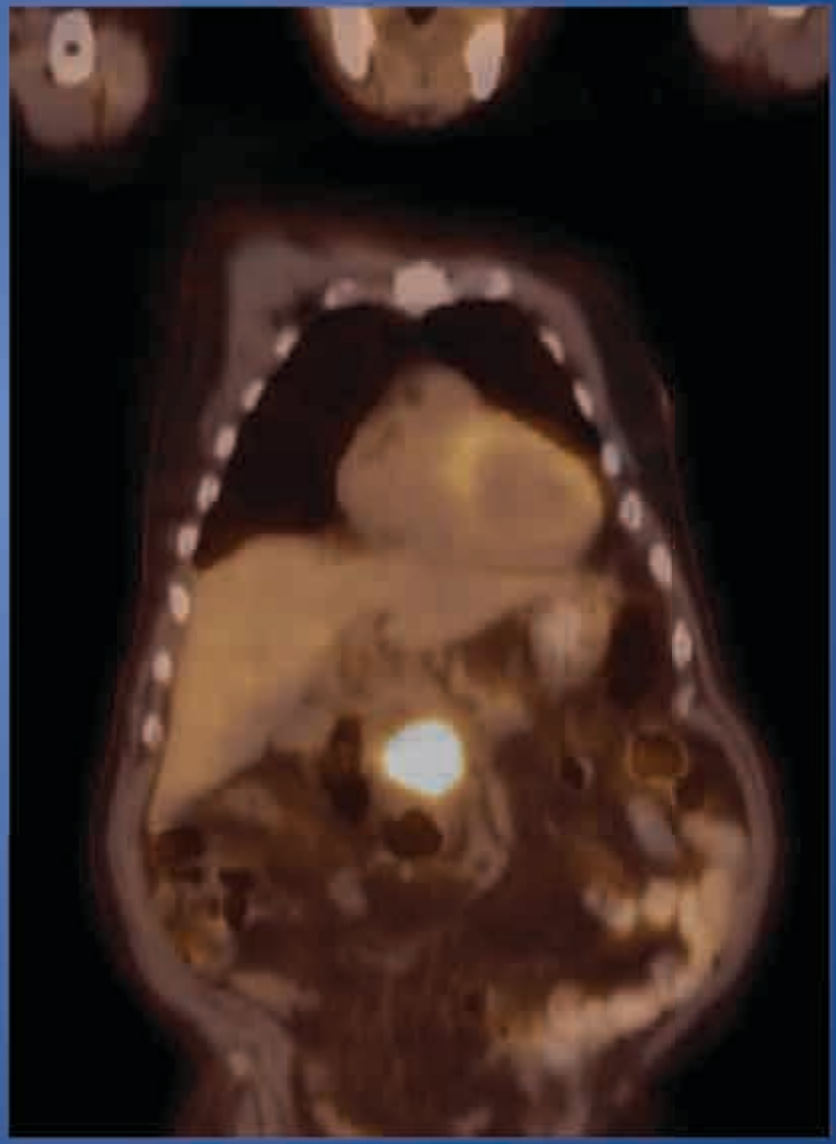












Pancreatic Irresectability

Liver Metastases

Lymph node Metastases

Adjacent organ invasion (other than the duodenum)

Peritoneal carcinomatosis

Vascular Invasion

Pancreatic Irresectability

Liver Metastases

Lymph node Metastases

Adjacent organ invasion (other than the duodenum)

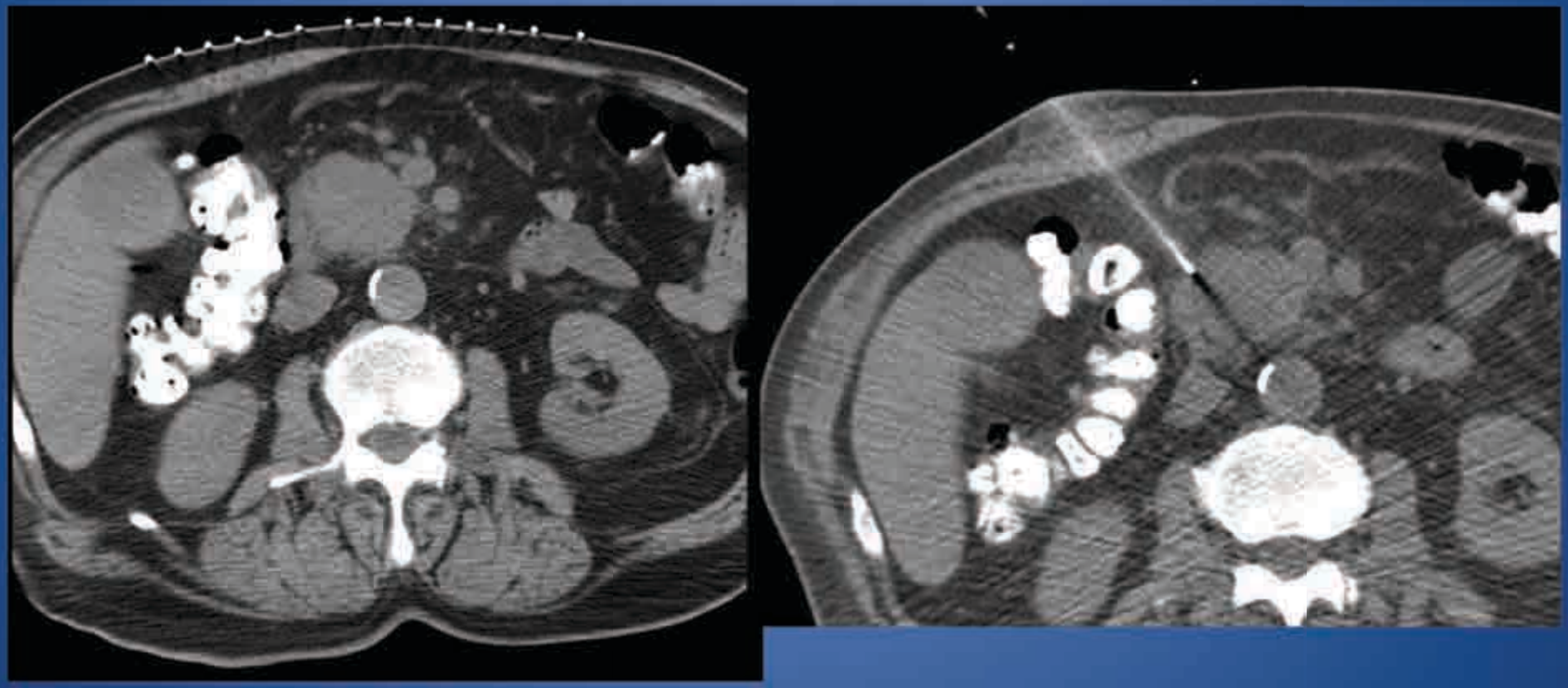
Peritoneal carcinomatosis

Vascular Invasion

Five Point Grading System by Lu et al. AJR 1997

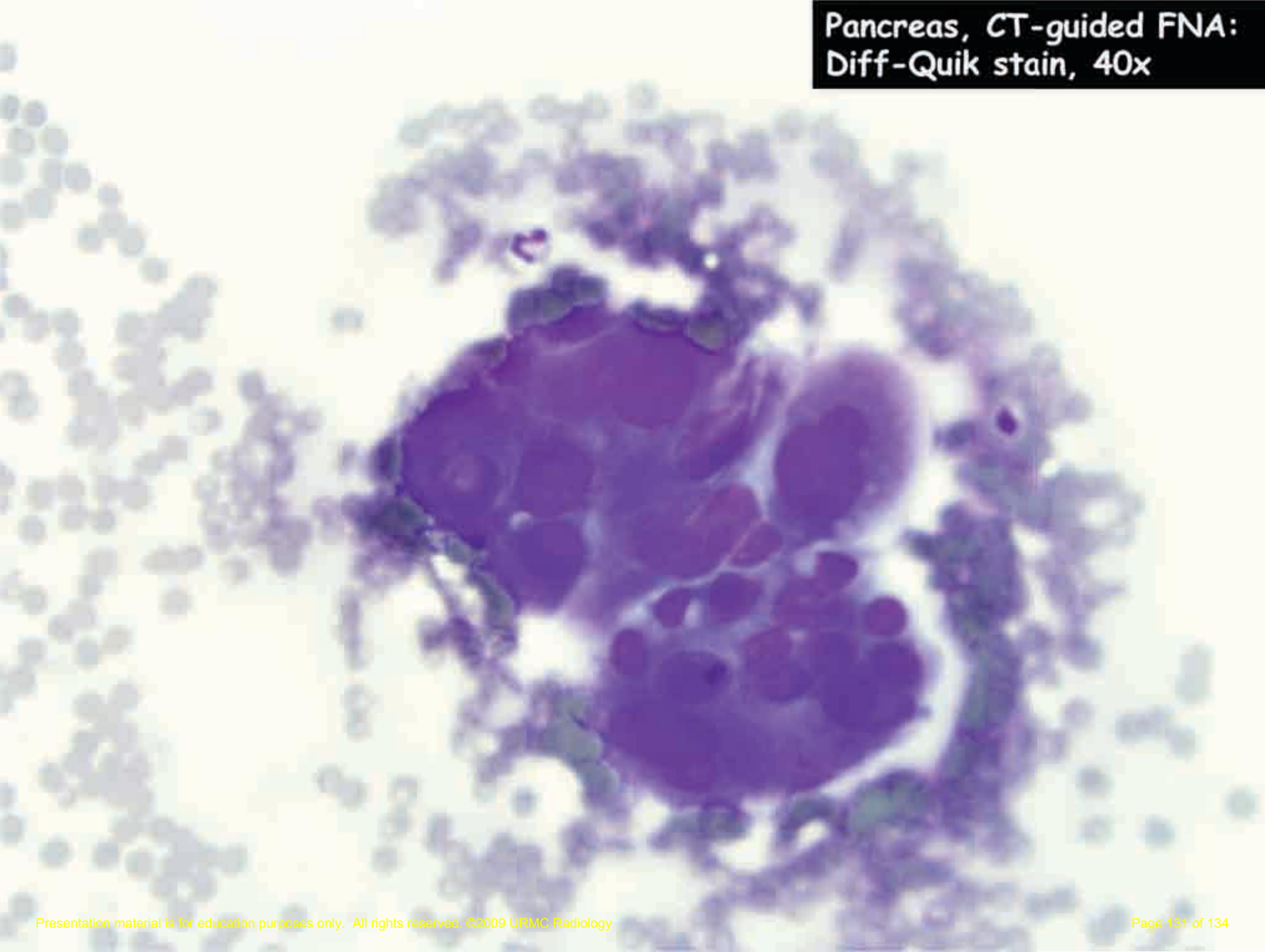
- Grade 0 – no circumferential contiguity
- Grade 1 – 0-25%: Almost all resectible
- Grade 2 – 25-50%: 57% irresectible
- Grade 3 – 50-75%: 88% irresectible
- Grade 4 – >75%: 100% irresectible

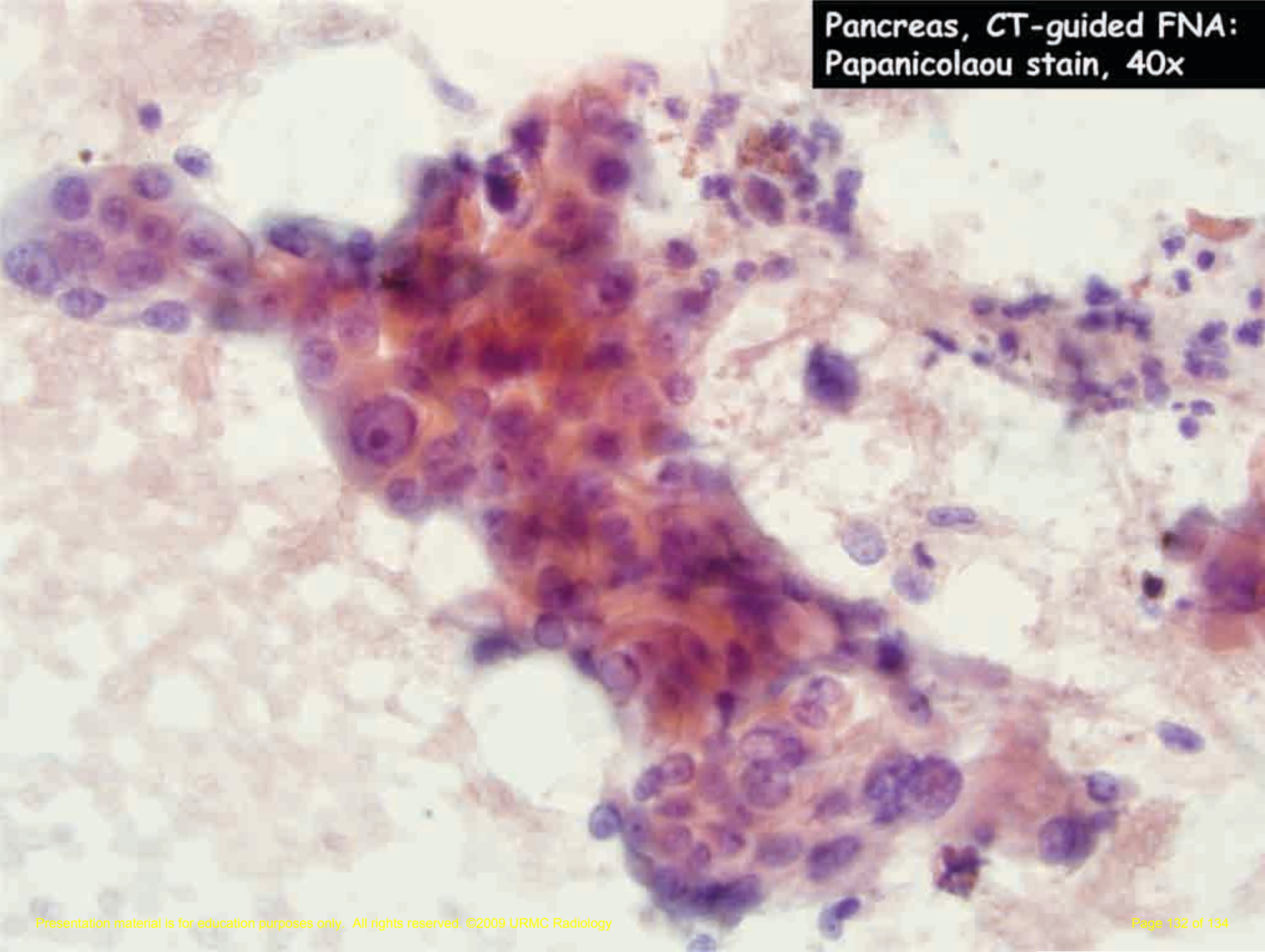
CT guided biopsy

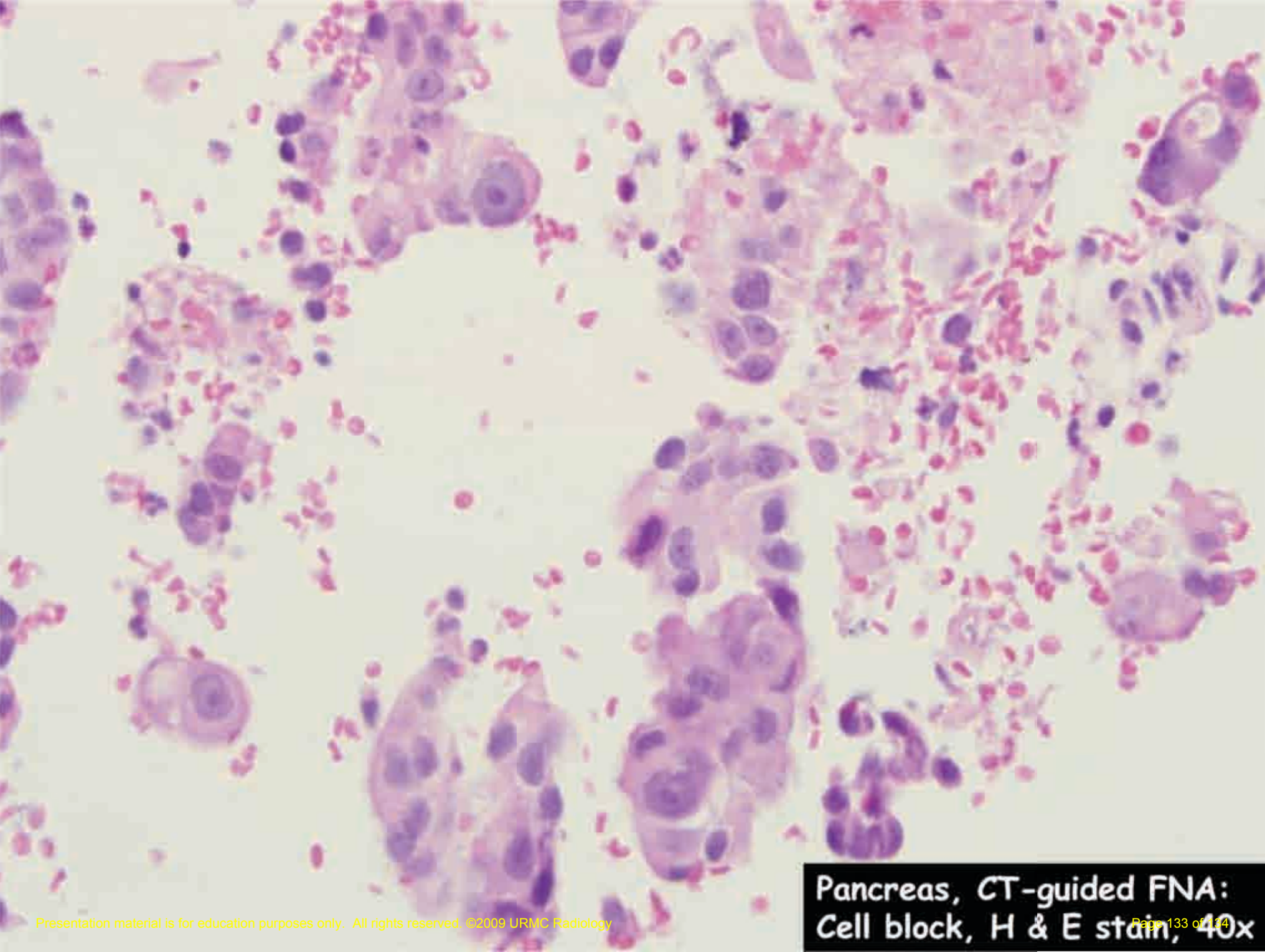


Case 5

Pancreas, CT-guided FNA:
Diff-Quik stain, 40x







Pancreas, CT-guided FNA:
Cell block, H & E stain, 40x

Pancreas, CT-guided fine needle aspiration:

Malignant tumor cells present derived from adenocarcinoma.