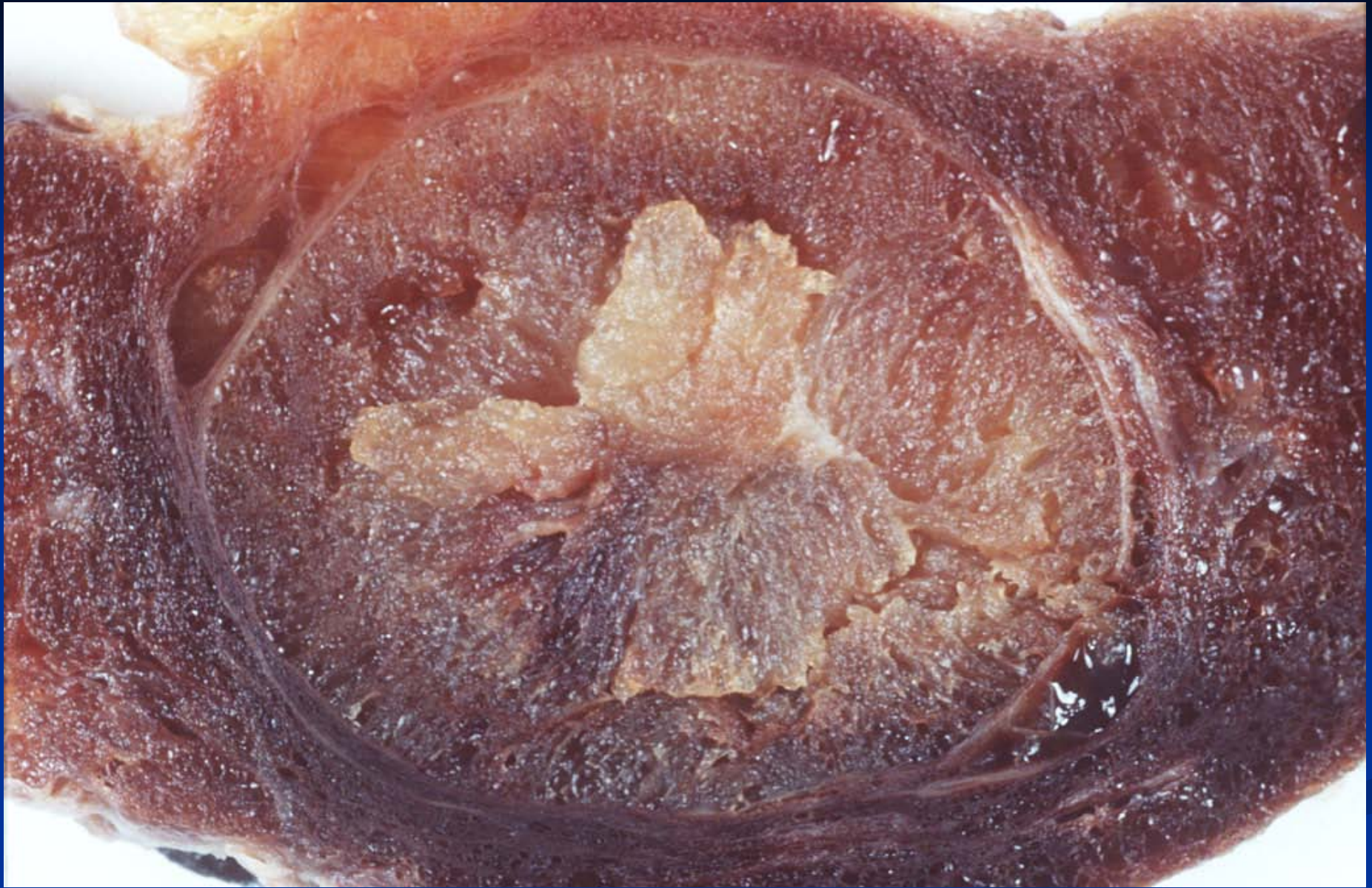


# Ultrasound of the Thyroid – a practical approach .

Rhodri M.Evans



# Incidence of nodules.

- 3 – 7% have palpable nodule
- 30 – 70% have nodules detected on Ultrasound

x 10 Increase in incidence of nodules with  
Ultrasound .

Incidence

# Thyroid Nodules

70

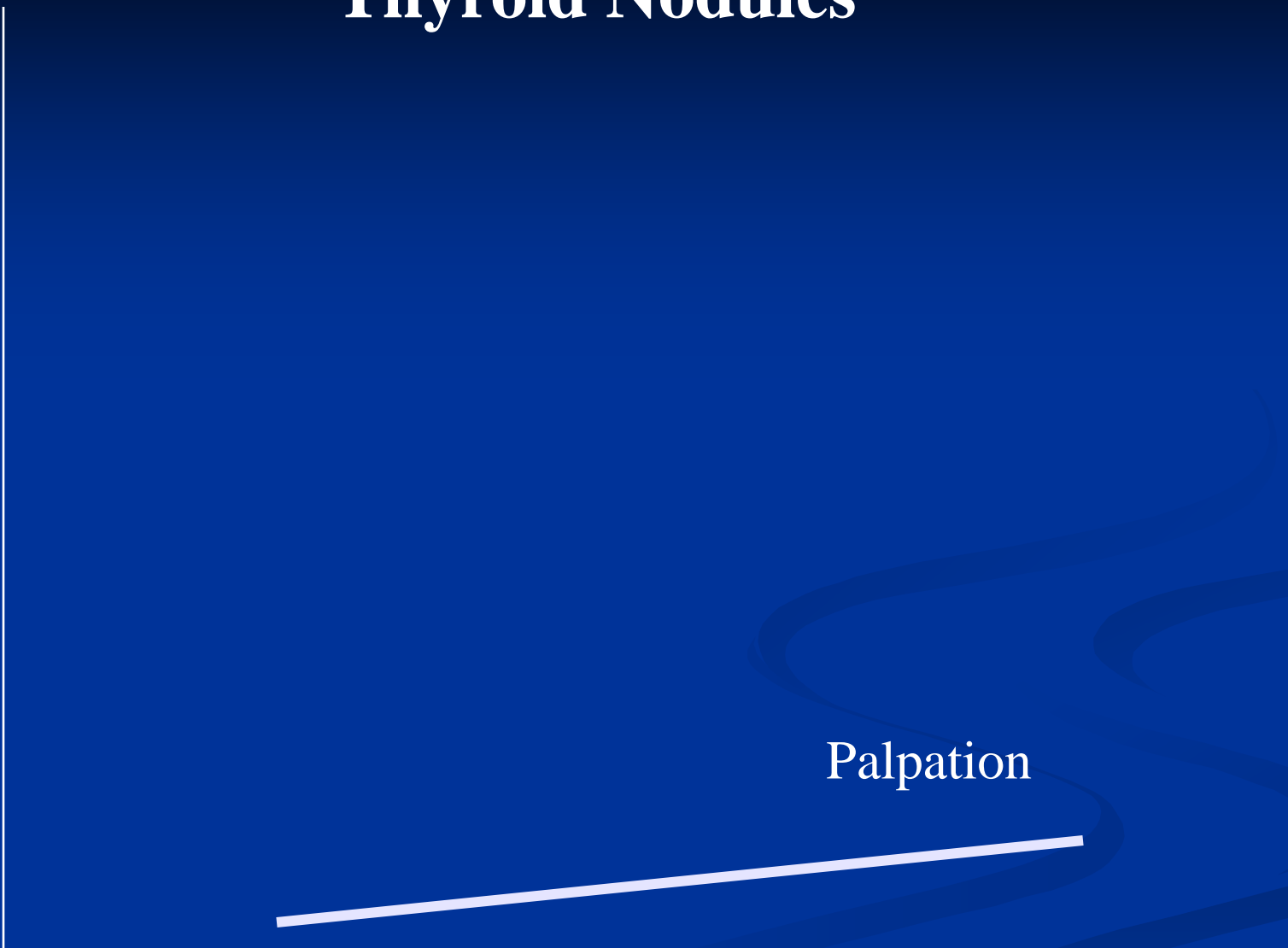
30

Palpation

50

Age

100



Incidence

# Thyroid Nodules

70

30

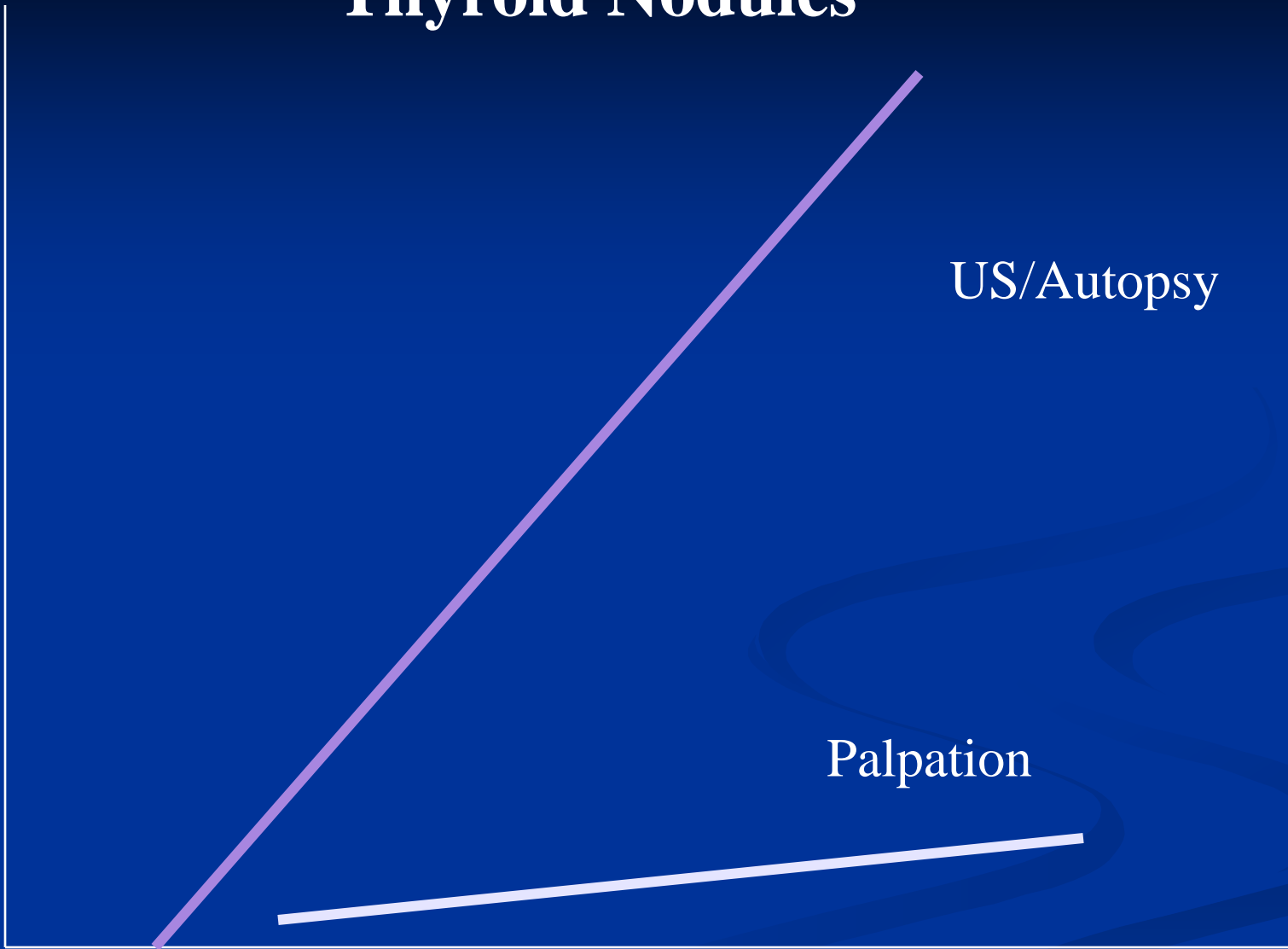
US/Autopsy

Palpation

50

Age

100

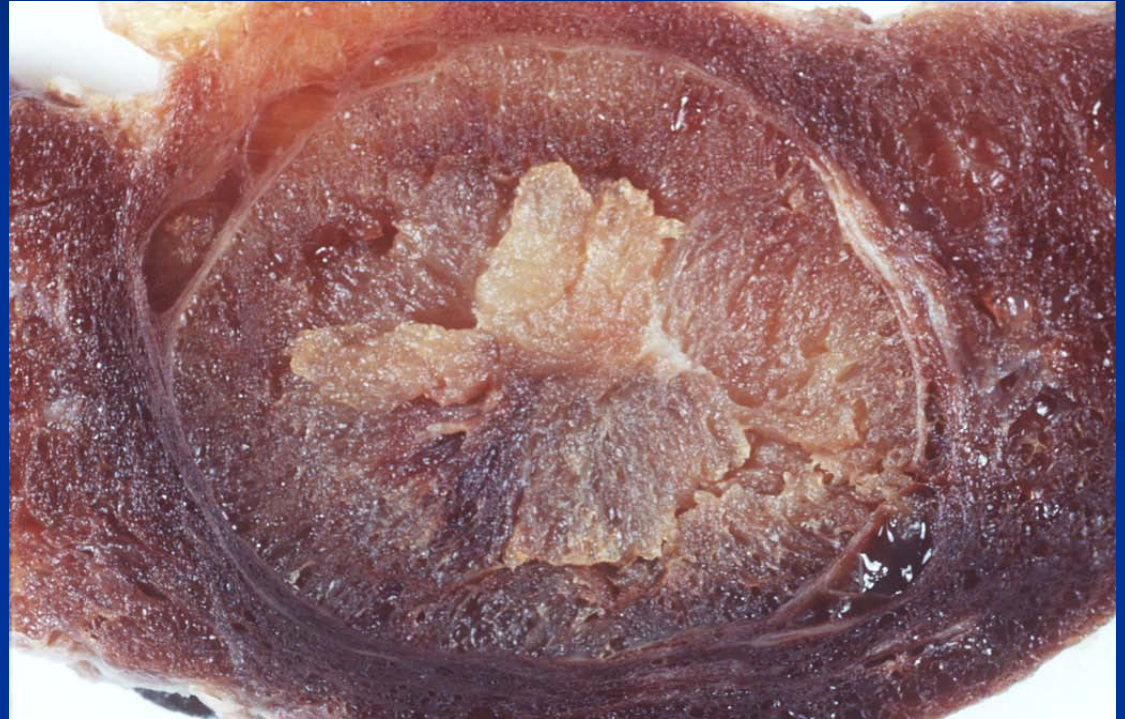


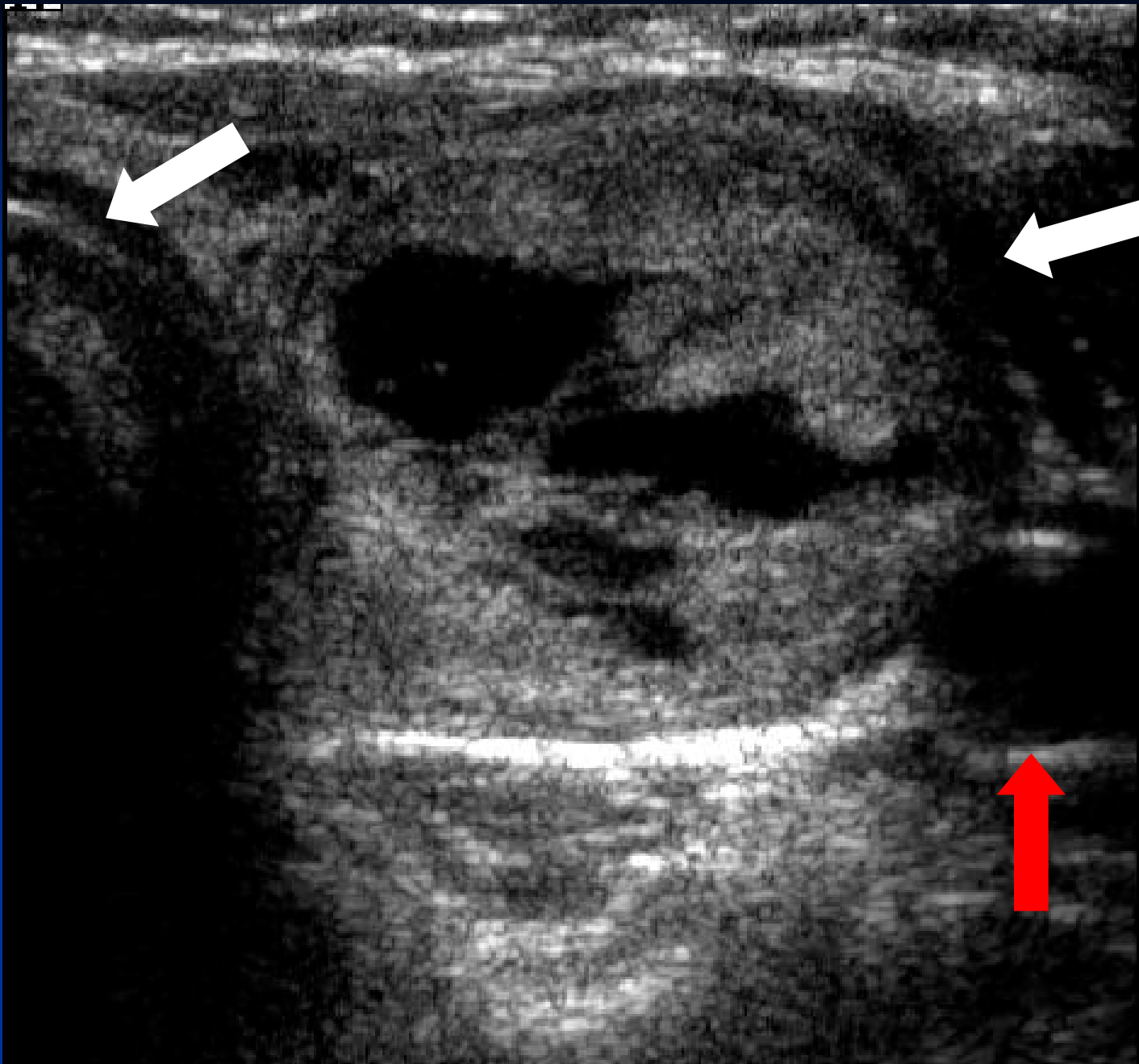
# Incidence of malignancy?

- 1000 new cases per annum in England and Wales ( 0.002%)
- 1 new case per 50,000 , per year.
- 250,000 population = 5 new cases/year
- 500,000 population=10 new cases/year.

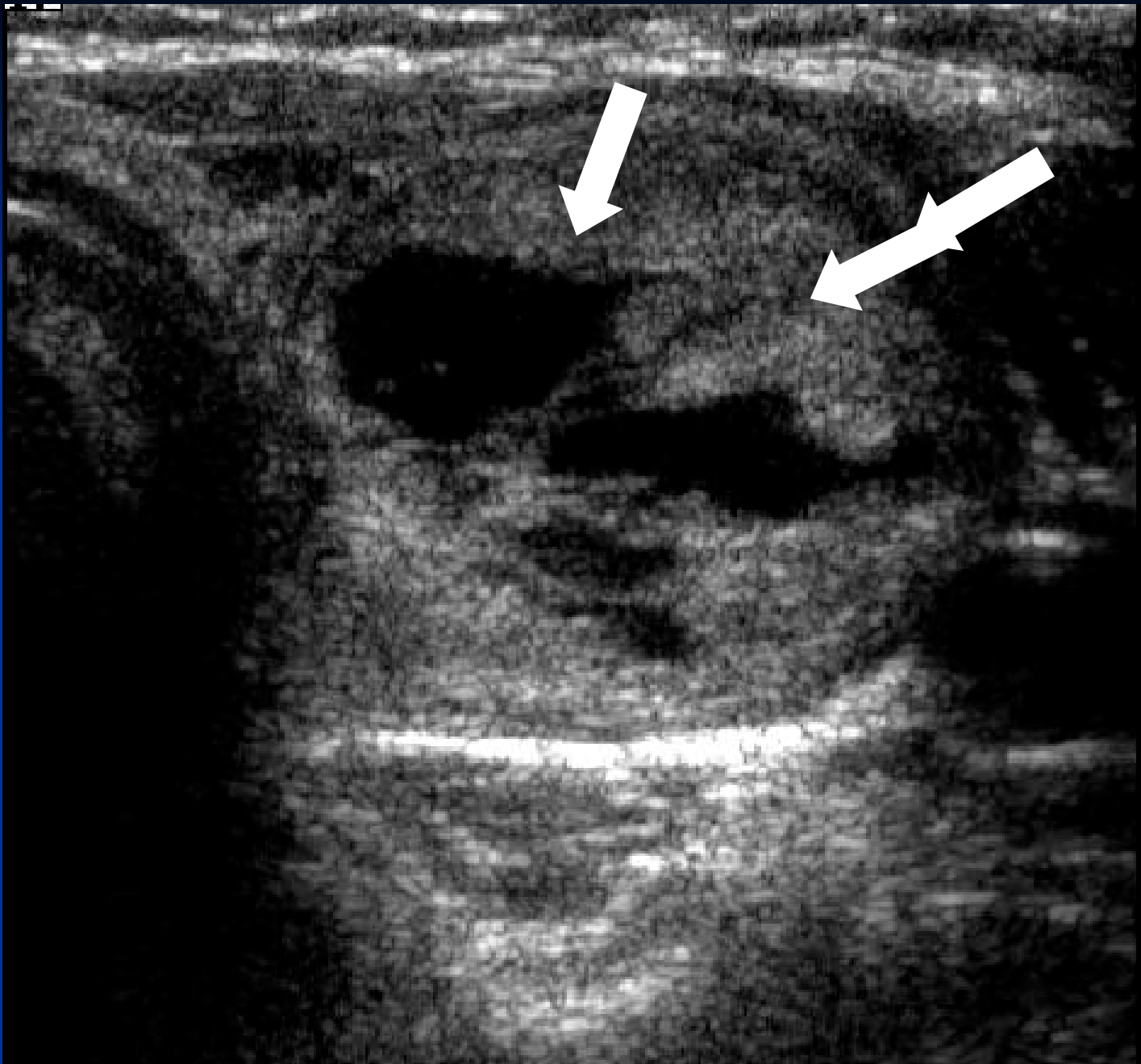
# Thyroid nodules.

- A problem?
- The solution?
- Ultrasound.





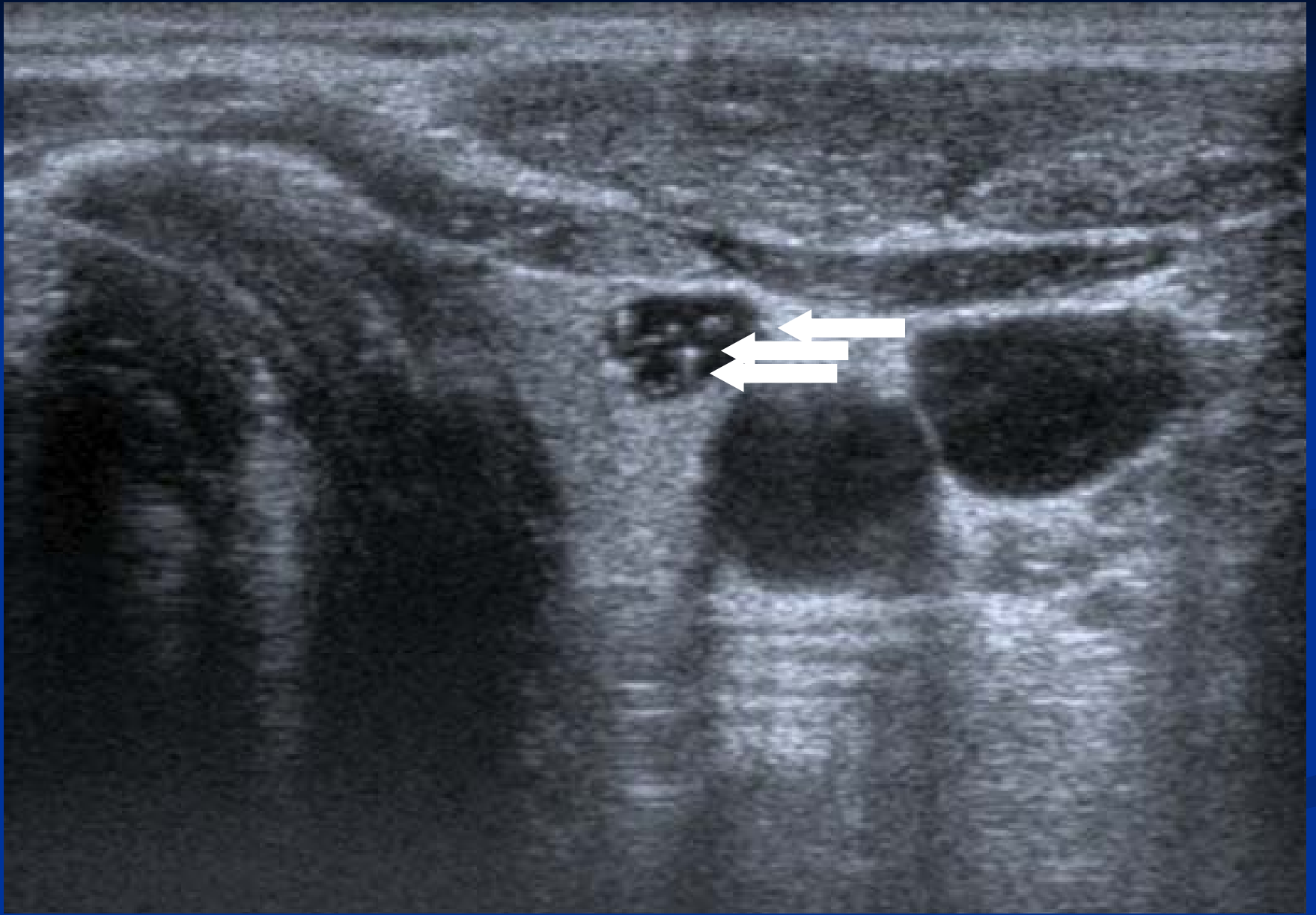




# Signs?

- 426 resected nodules, surgical correlation
- Benign nodules :iso/hyper-echoic and contain cystic degenerative change with a perinodular hypoechoic rim

Brkljacic et al, J Clin US;22:71-76.1995.





0 ◆

T



MI: 1.6

2DG

98

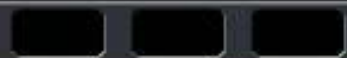
DR

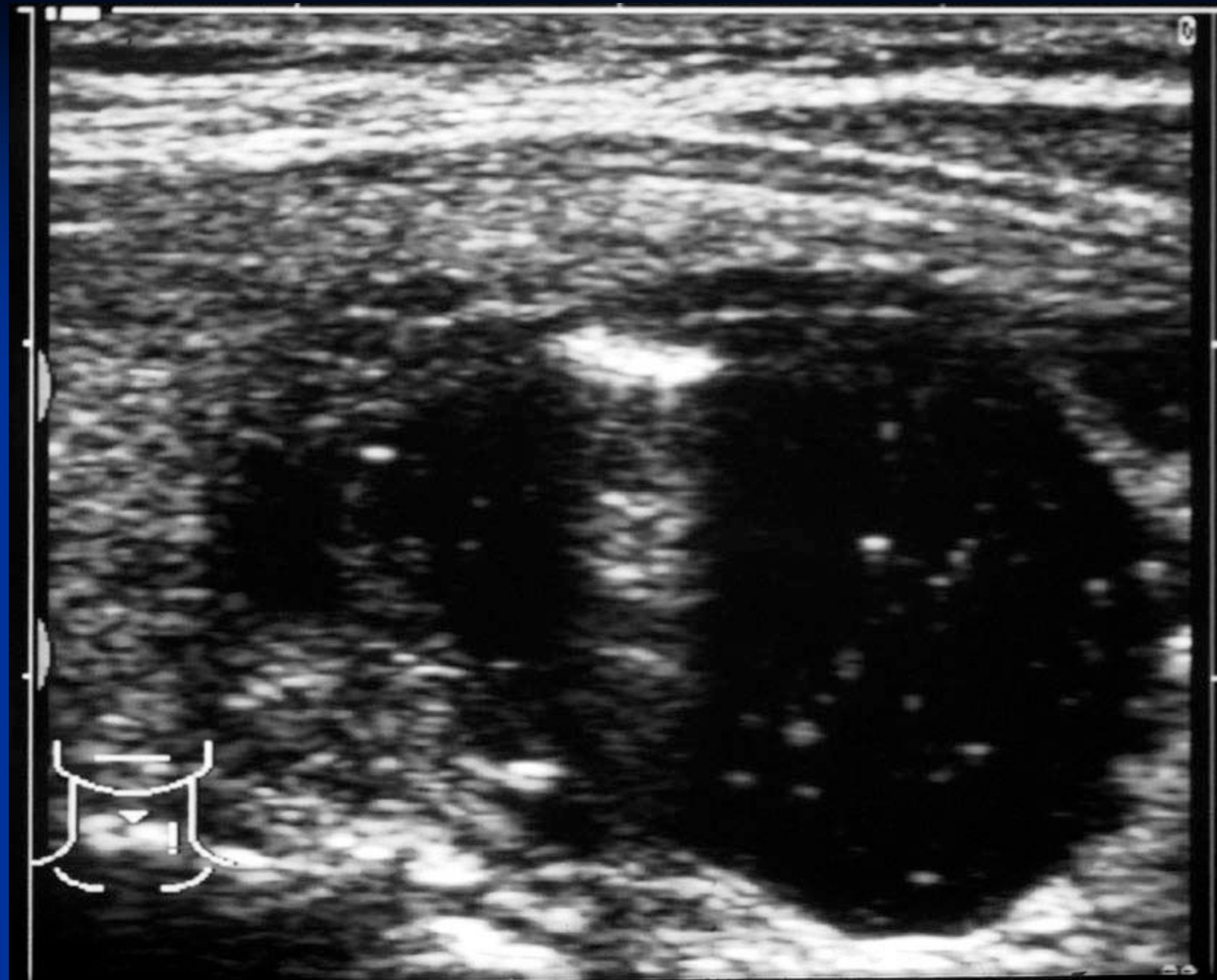
60

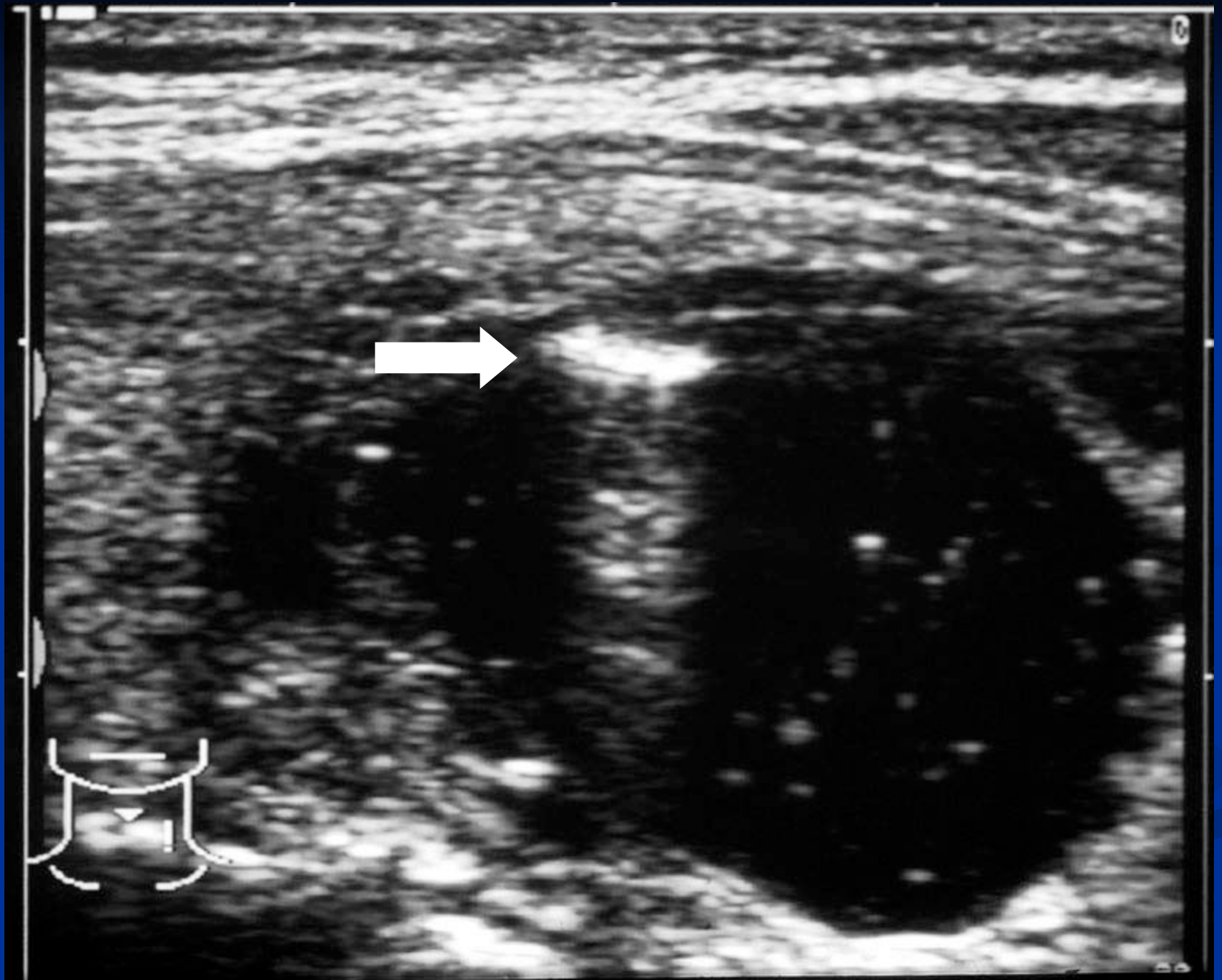
12L5

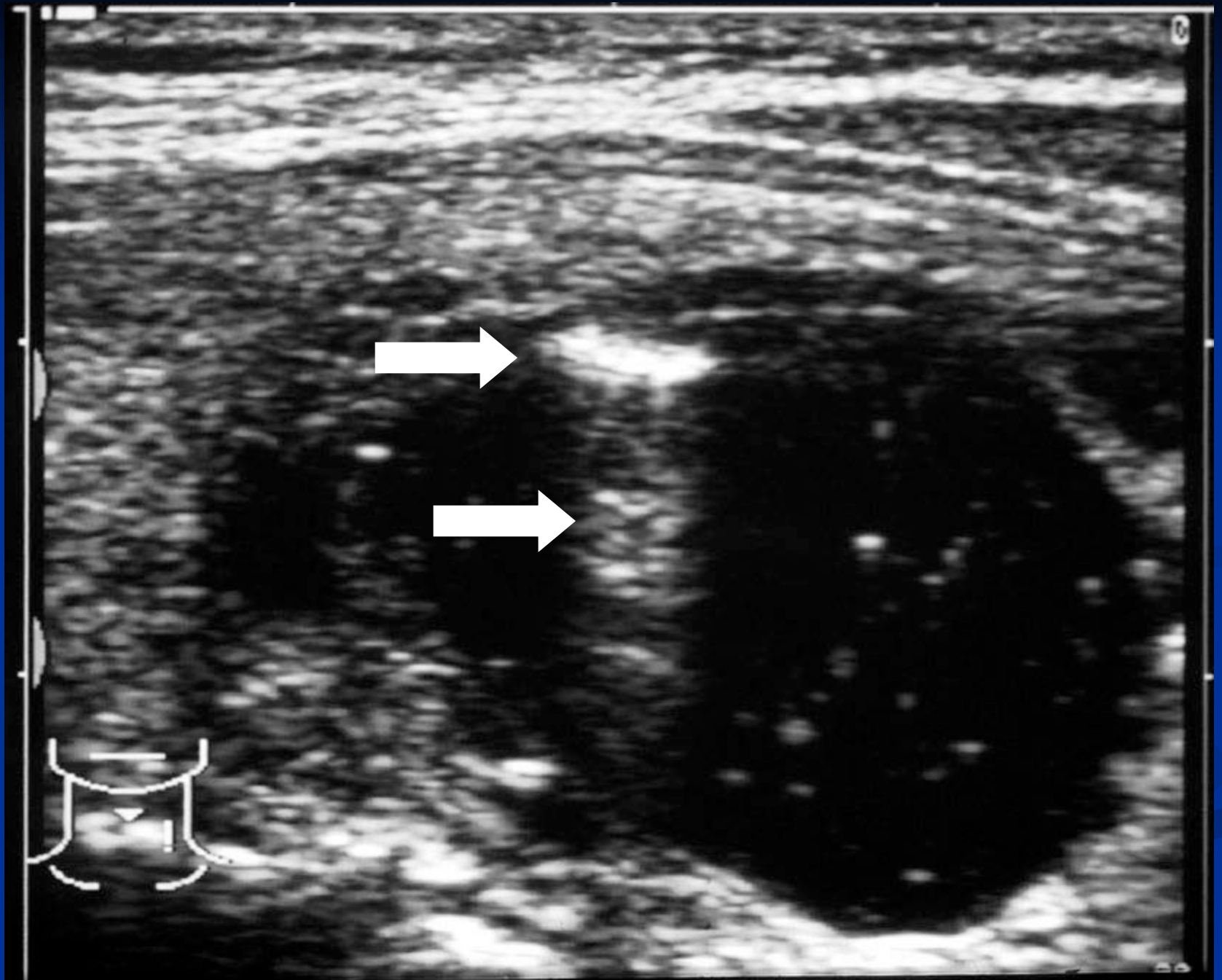
T9.0

14 fps







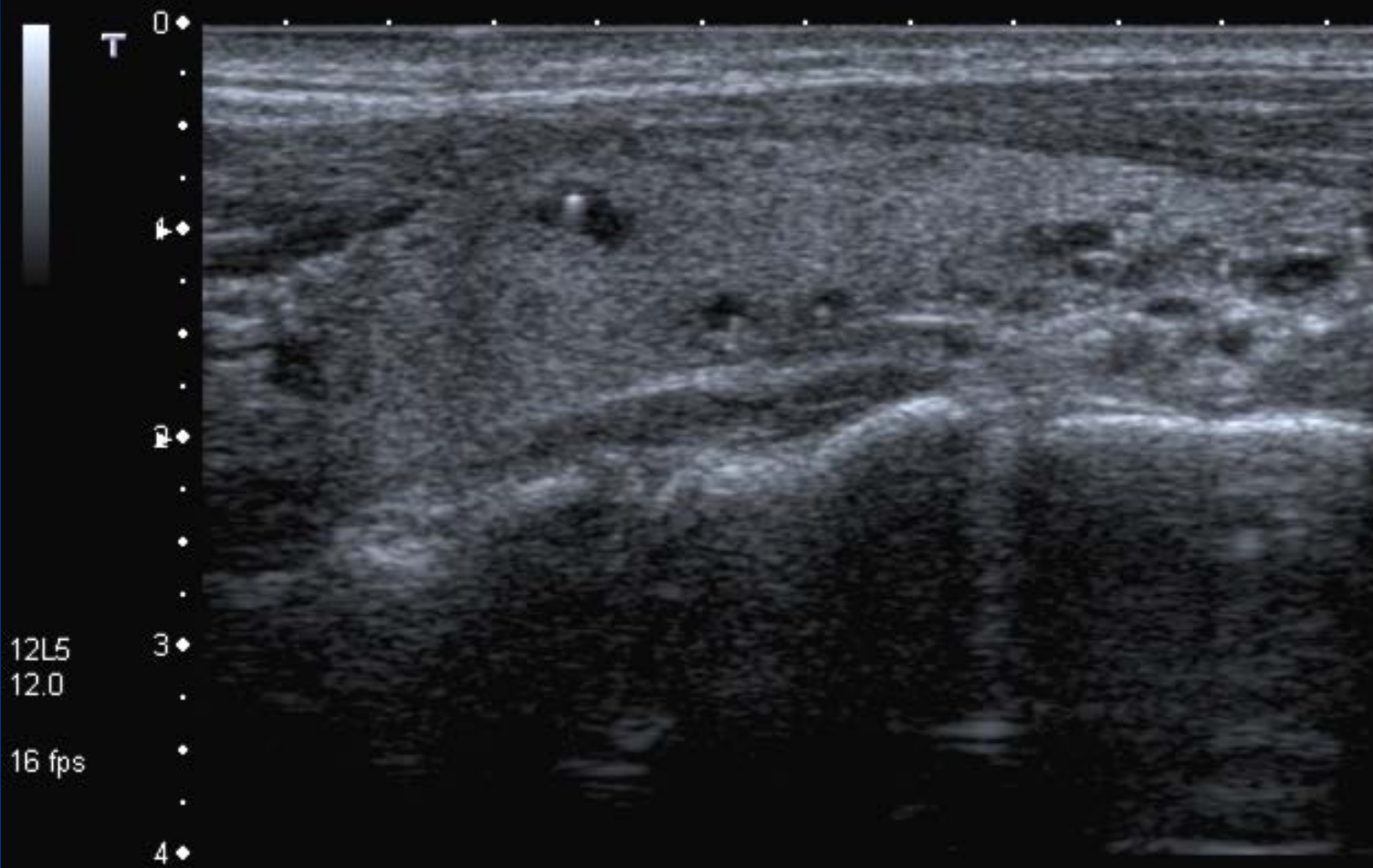


# Signs?

- Comet tail sign
- Solitary paper and reference
- 100 patients ,cytological diagnosis
- 85% of patients with the sign showed an abundance of colloid

Ahuja et al, J Clin US, 1996, 24:129-133.



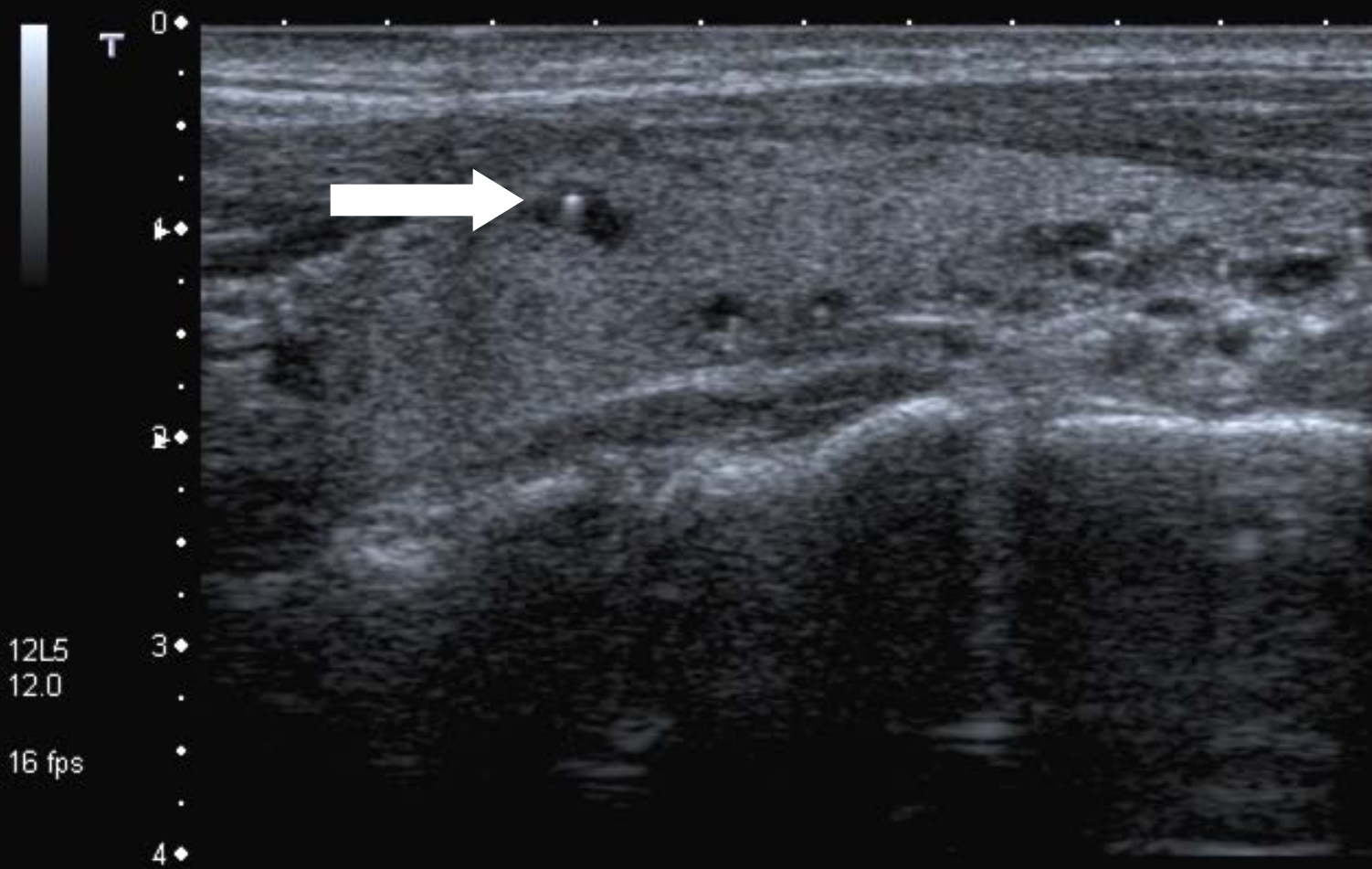


2DG  
84  
DR  
55

12L5  
12.0  
16 fps

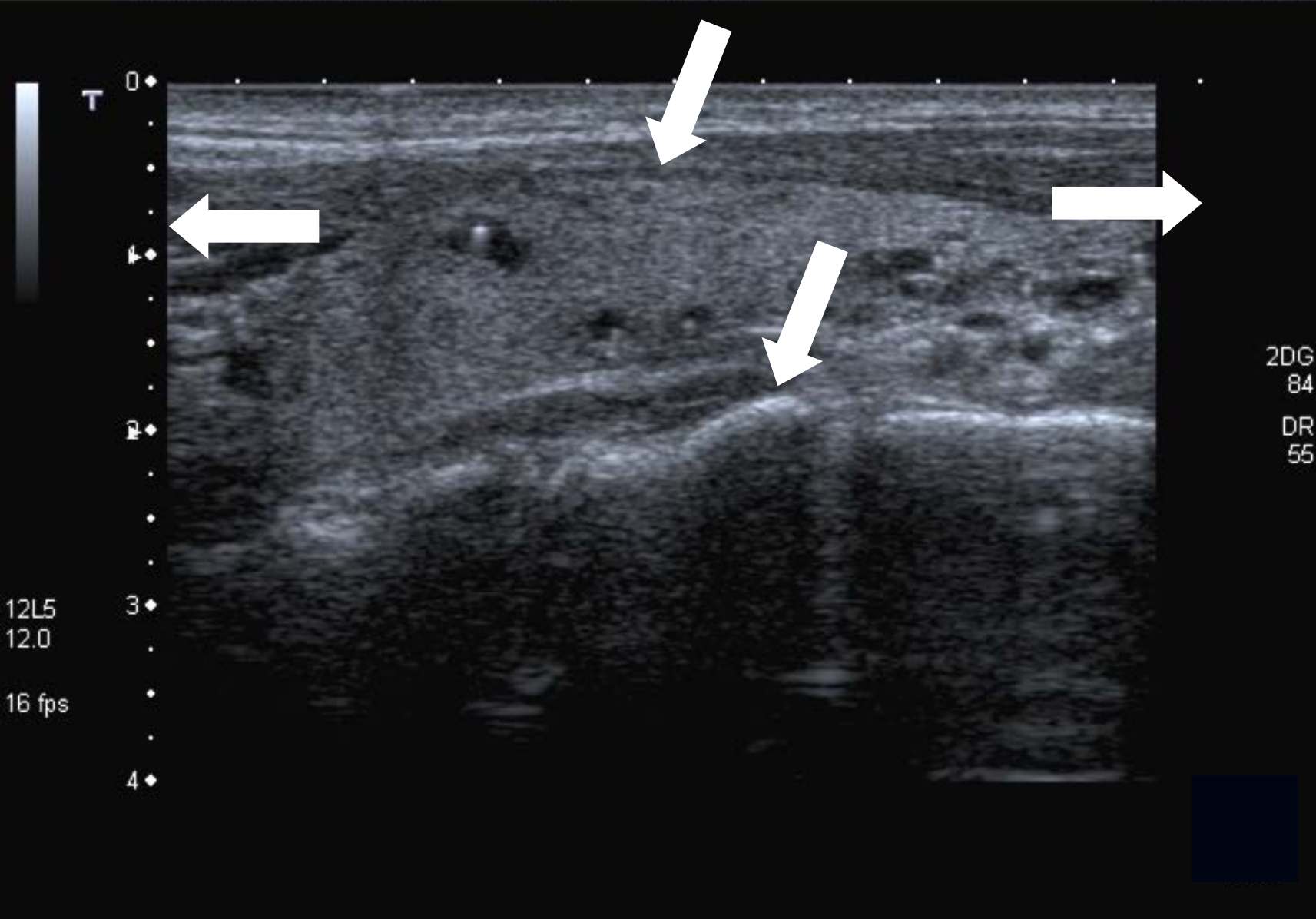
0  
1  
2  
3  
4





2DG  
84  
DR  
55





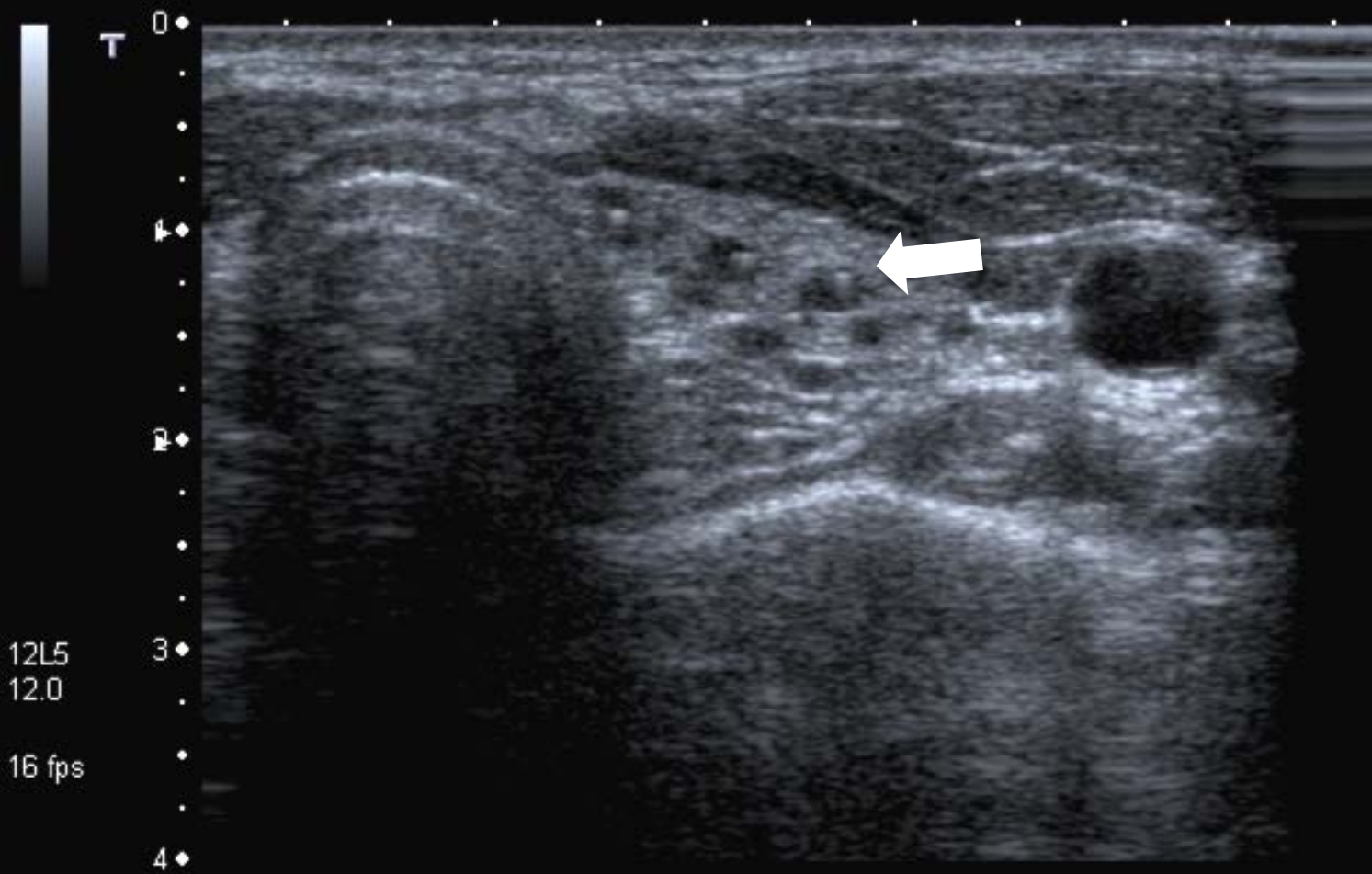


12L5  
12.0

16 fps

2DG  
84  
DR  
55





2DG  
84  
DR  
55

12L5  
12.0  
16 fps

0  
1  
2  
3  
4



# Solitary versus multiple?

Indicator of malignancy?

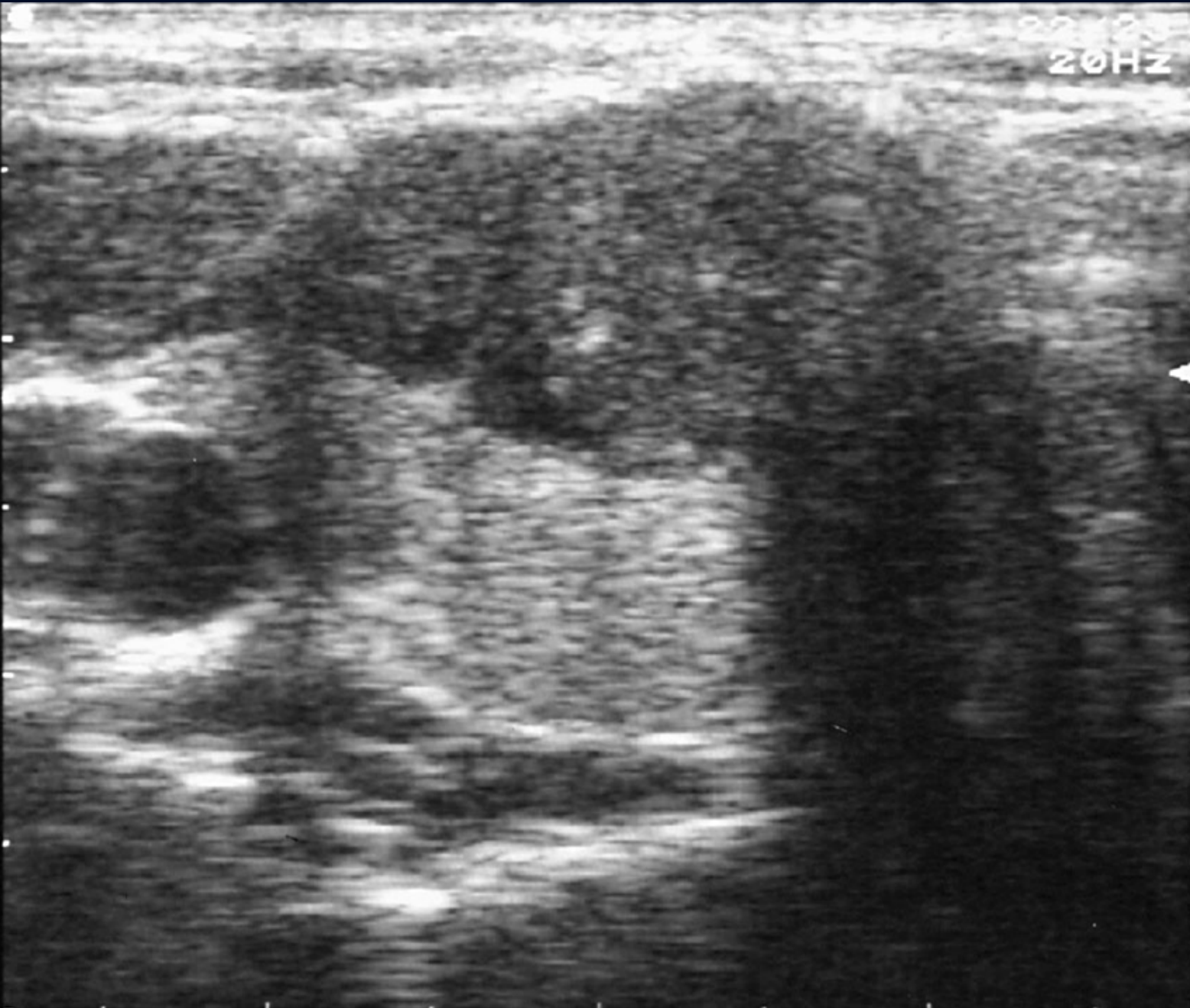
# Myth – solitary versus multiple.

## Cancer Rate

	Solitary	Multiple
Cochand	13%	14%
Marqusee	7%	9%
Papini	9%	6%

2012  
20HZ

CGR  
03  
090  
02

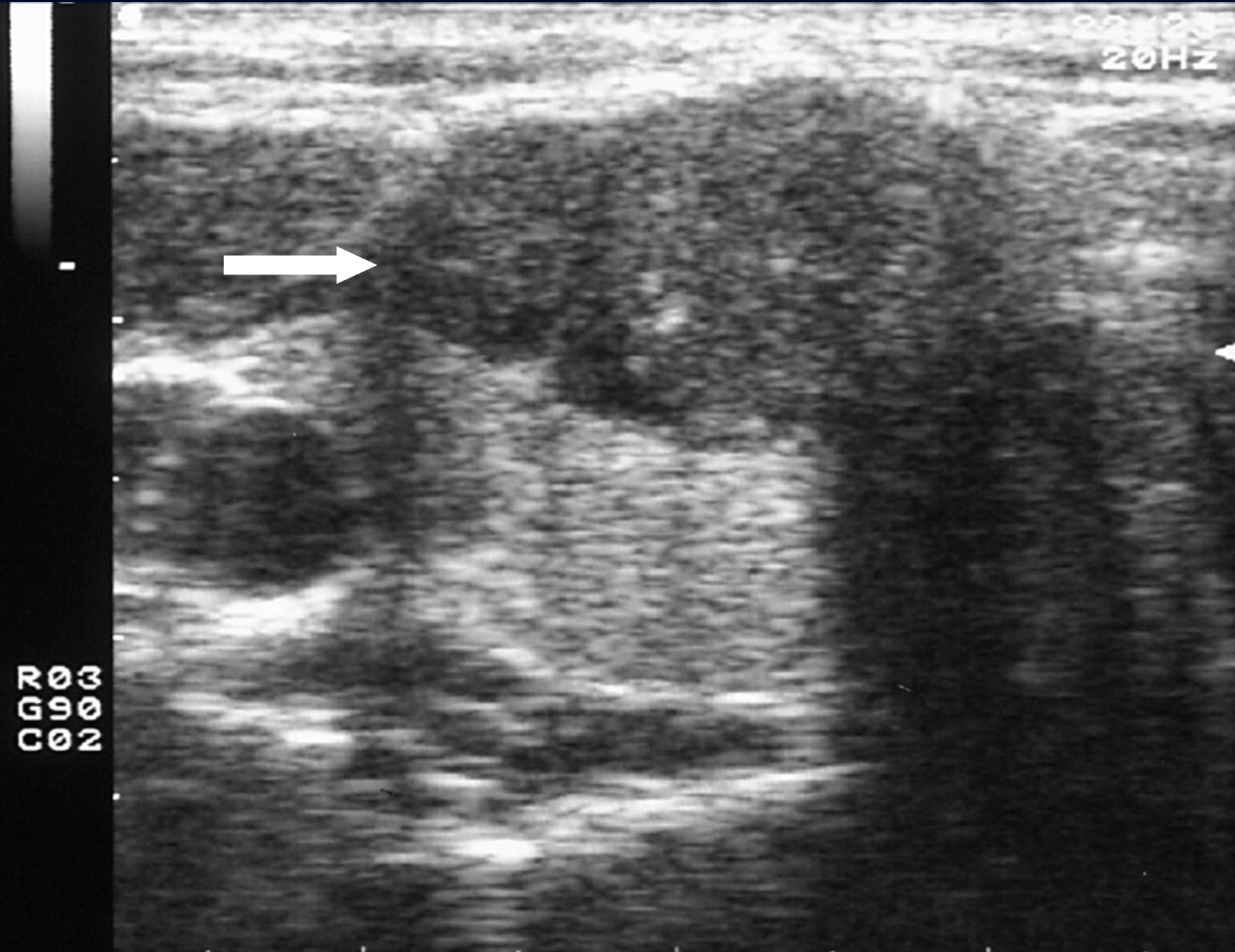




22 23  
20HZ



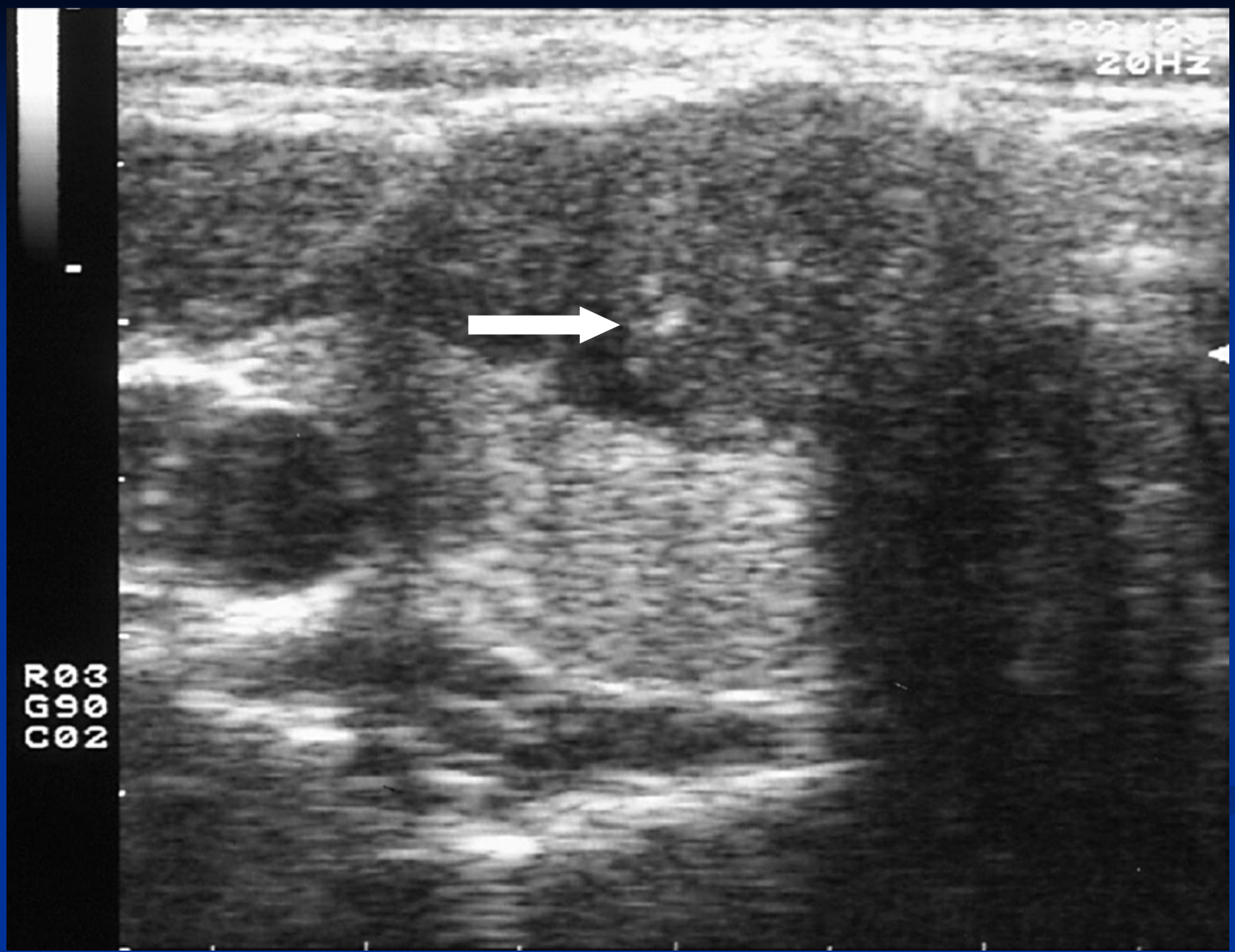
CGR03  
CG90  
C02



22/23  
20HZ



CGR03  
CG90  
C02

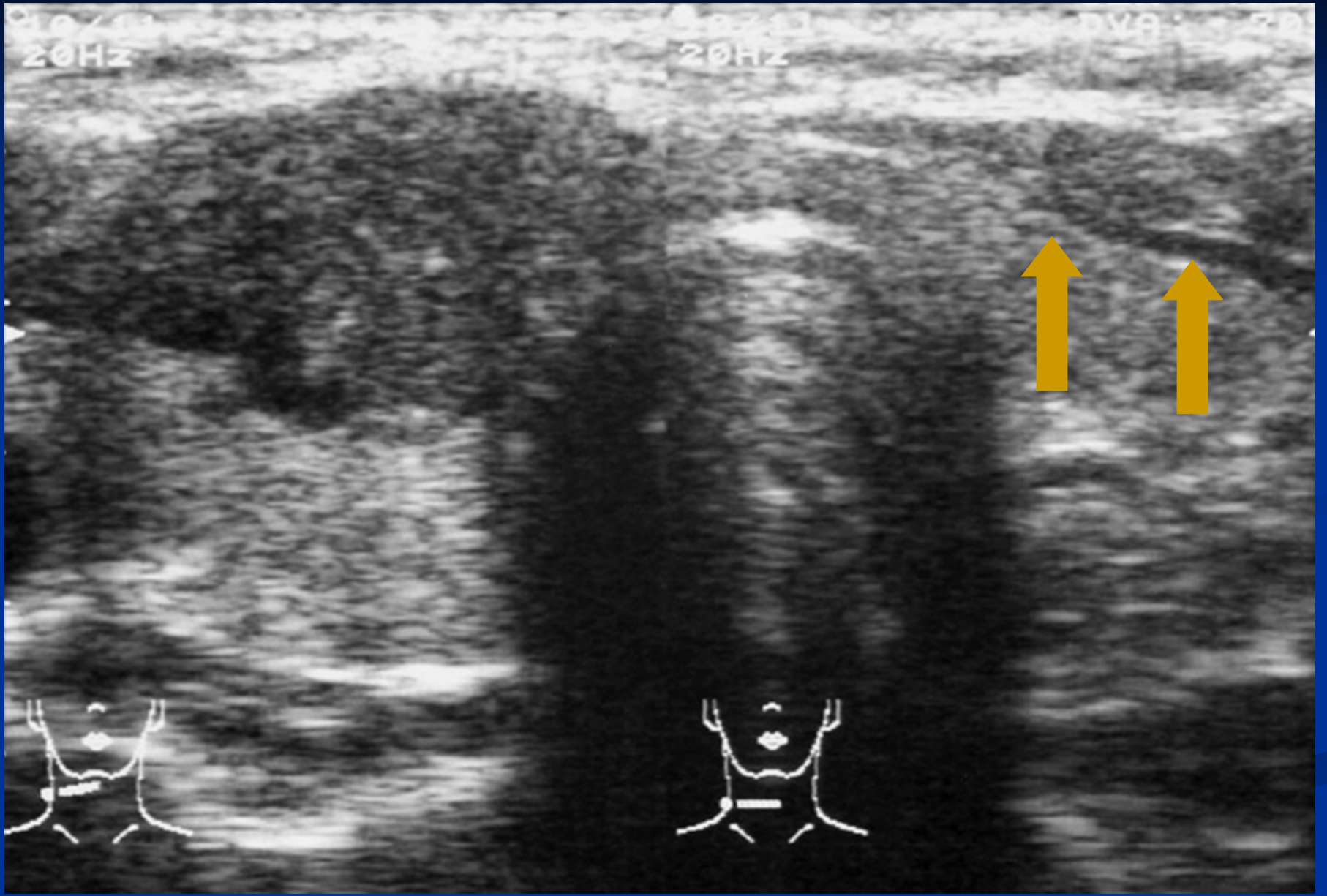


010713  
20Hz

010713  
20Hz

DVA 20







# Incidence of Papillary carcinoma?

- 6,499 patients:US and FNAC
- 164 cases( incidence : 2.52%) of malignancy :
  - 116 Papillary Ca
  - 23 Follicular Ca
  - 6 Medullary Ca
  - 7 Anaplastic Ca
  - 8 Hurthle Cell Ca
  - 4 Lymphomas

Lin et al,Acta  
Cytol,1997;41:687-691.

# Occult Incidence.

- Autopsy series.
- Small (less than 1cm) papillary tumours : “micro-carcinomas”.
- Reported incidence : 10-30%.

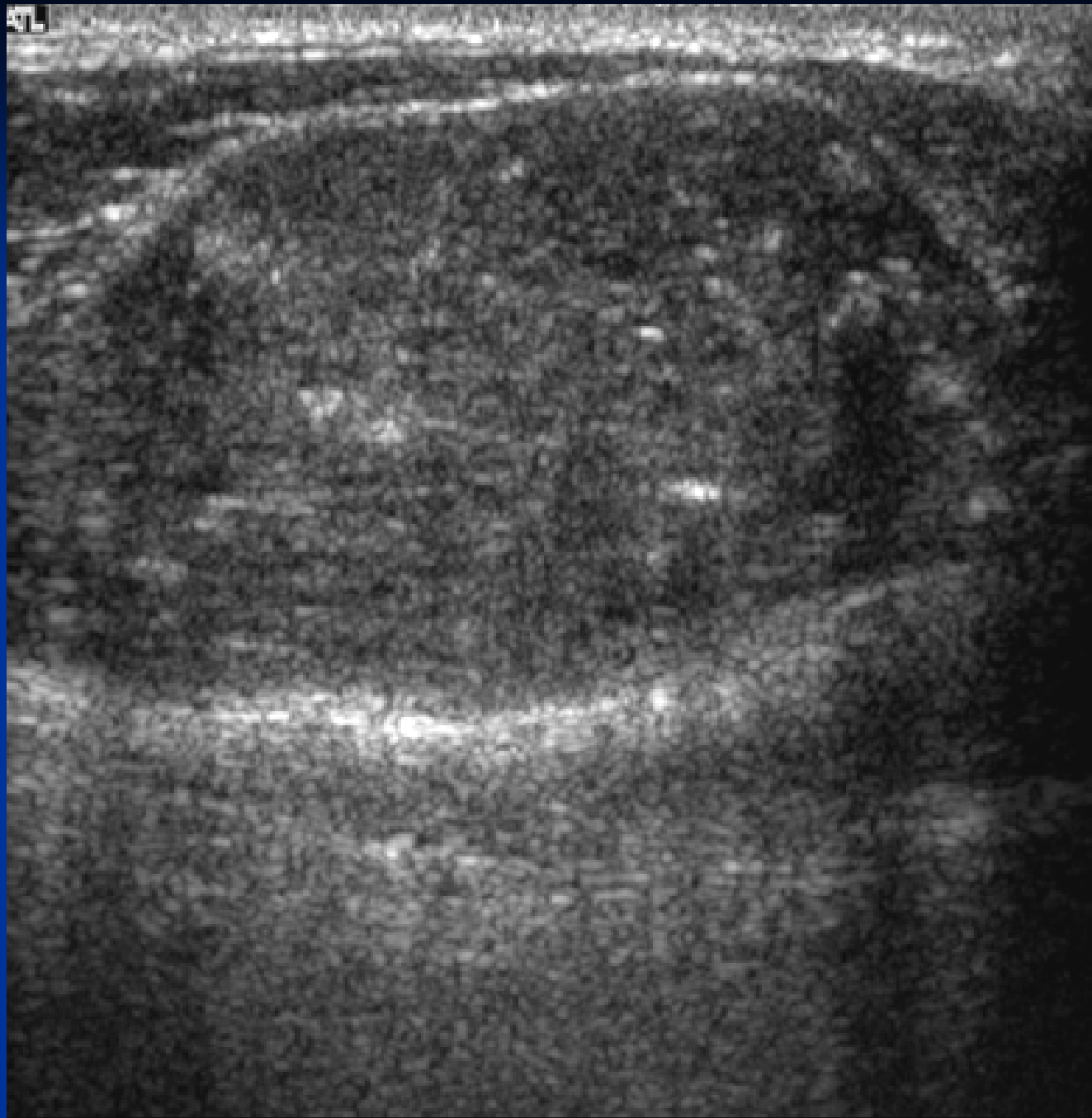
# Papillary Carcinoma.

- Papillary carcinoma : indolent tumour
- 20 year survival : 90%

K Jones, CME  
Endocrinol, 2002; (1)4, 4-9.



57L

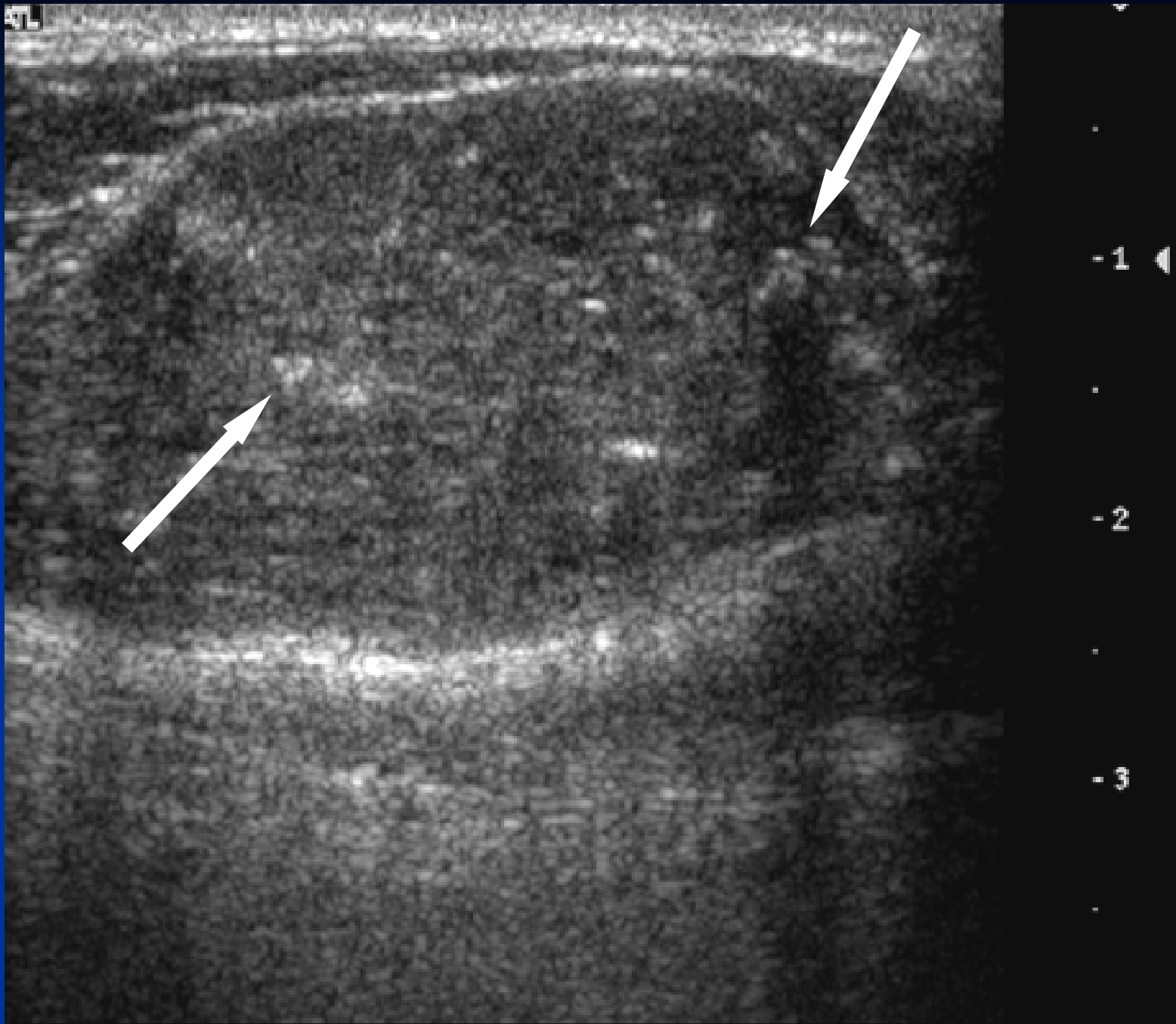


-1

-2

-3

CTL

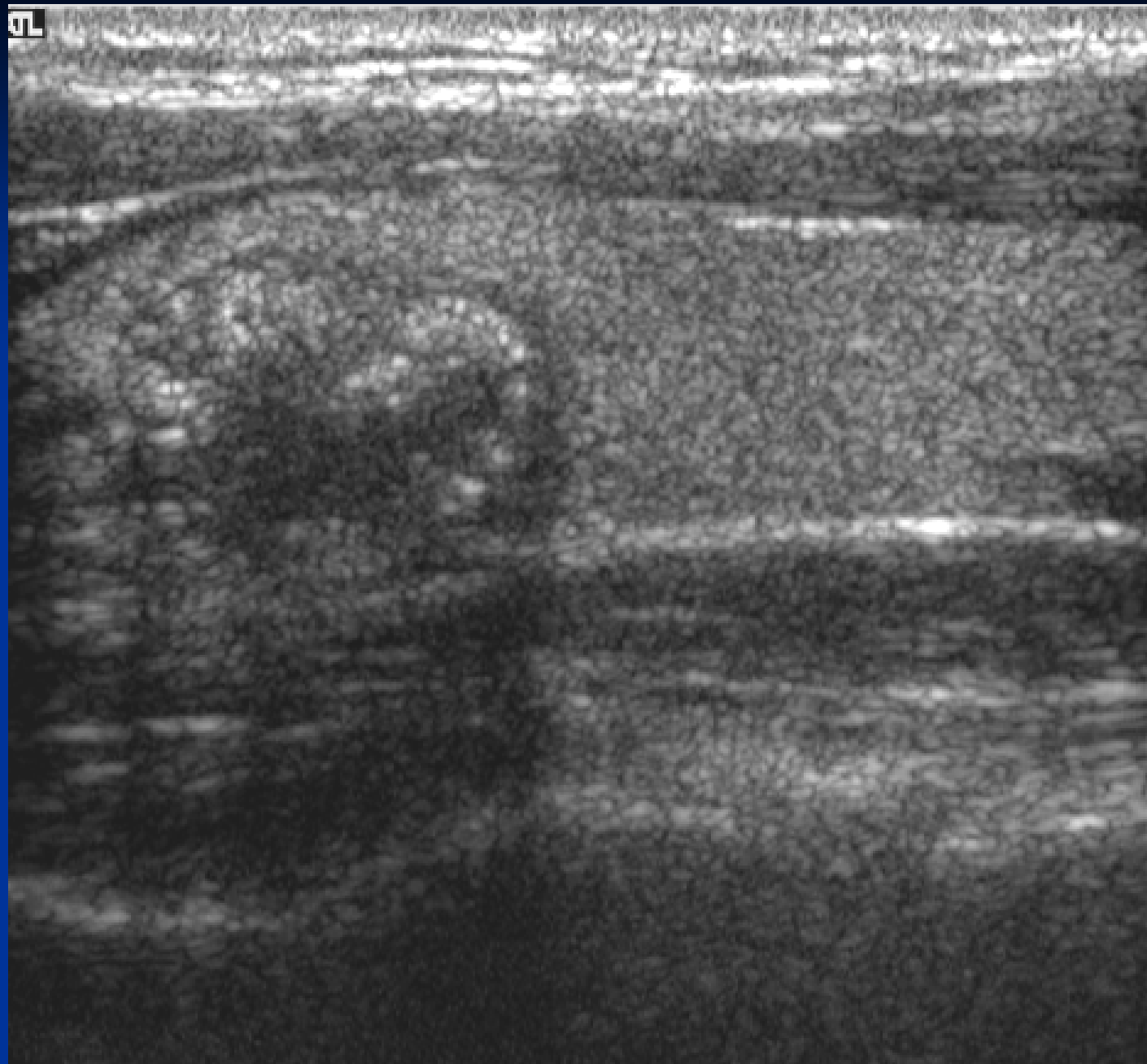


-1

-2

-3

9

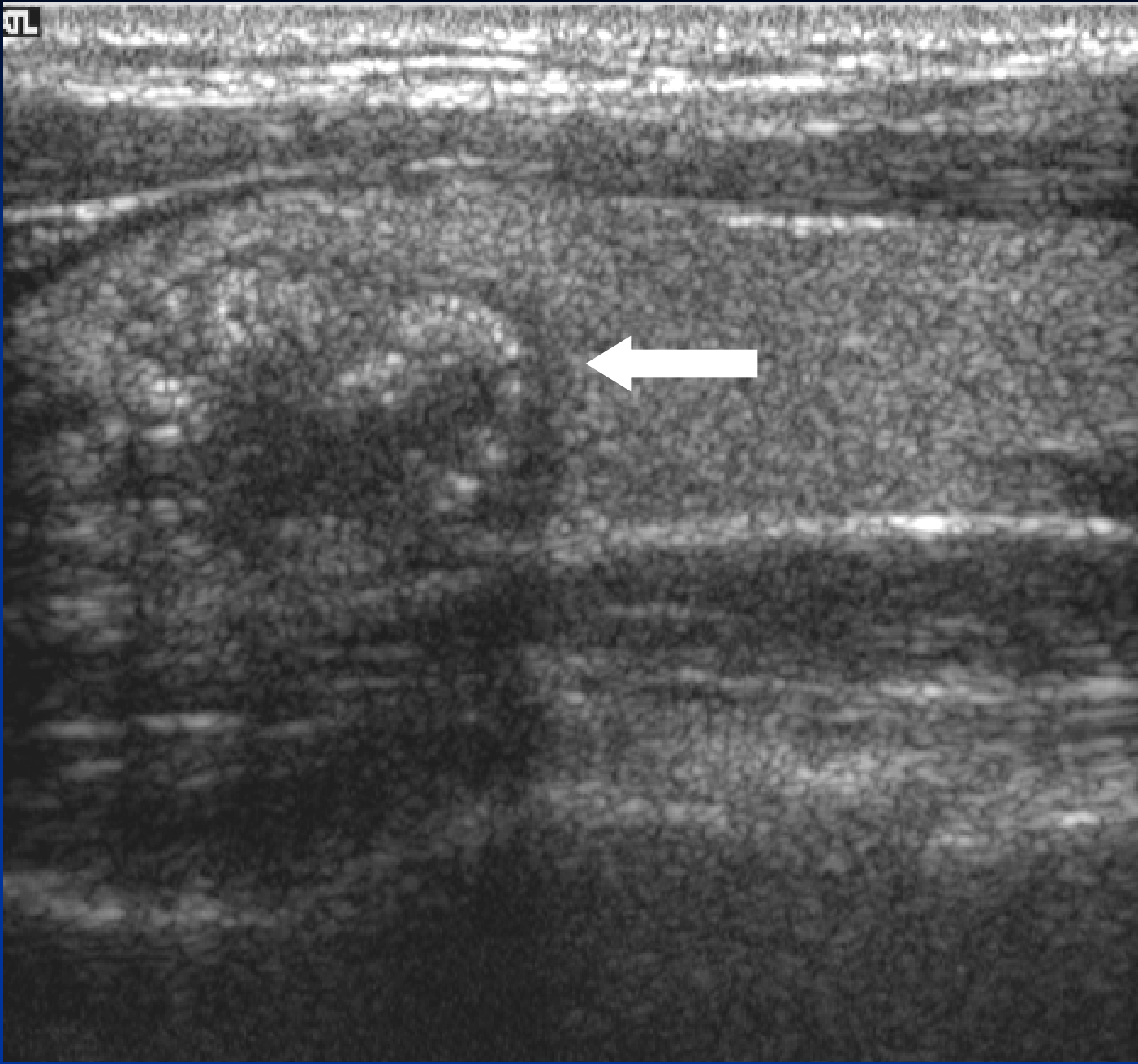


-1 ◀

-2

-3

91



-1 ◀

-2

-3

# Signs: papillary carcinoma?

- 259 pathologically verified thyroid nodules
- **Microcalcification:**

Accuracy 76%

Specificity 93%

PPV 70%

Sensitivity 36%

Takashima et al, J Clin  
US; 1995; 23(3), 179-184.



0 ◆

2 ◆▶

4 ◆



MI: 1.6  
2DG  
78  
DR  
65

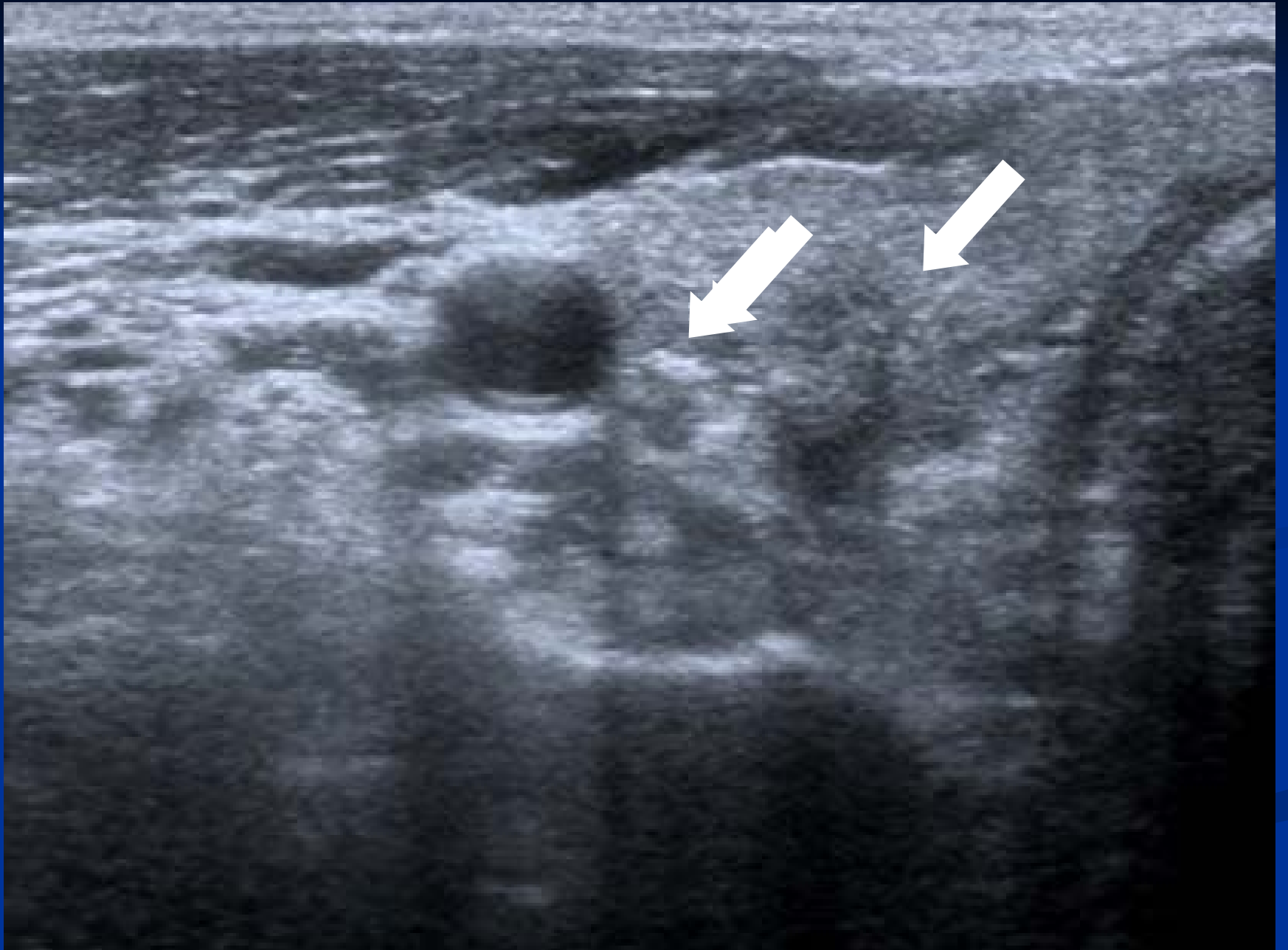
12L5  
diffT8.0

31 fps

A0 IP4

HDD: 73% Free





# Signs: papillary carcinoma?

- Combination of absent halo, microcalcification and type III (marked intranodular flow) most specific
- Specificity: 97.2%
- Sensitivity: 16.6%

Rago et al, Eur J  
Endocrinol., 1998; 138, 41-46



# Follicular carcinoma.

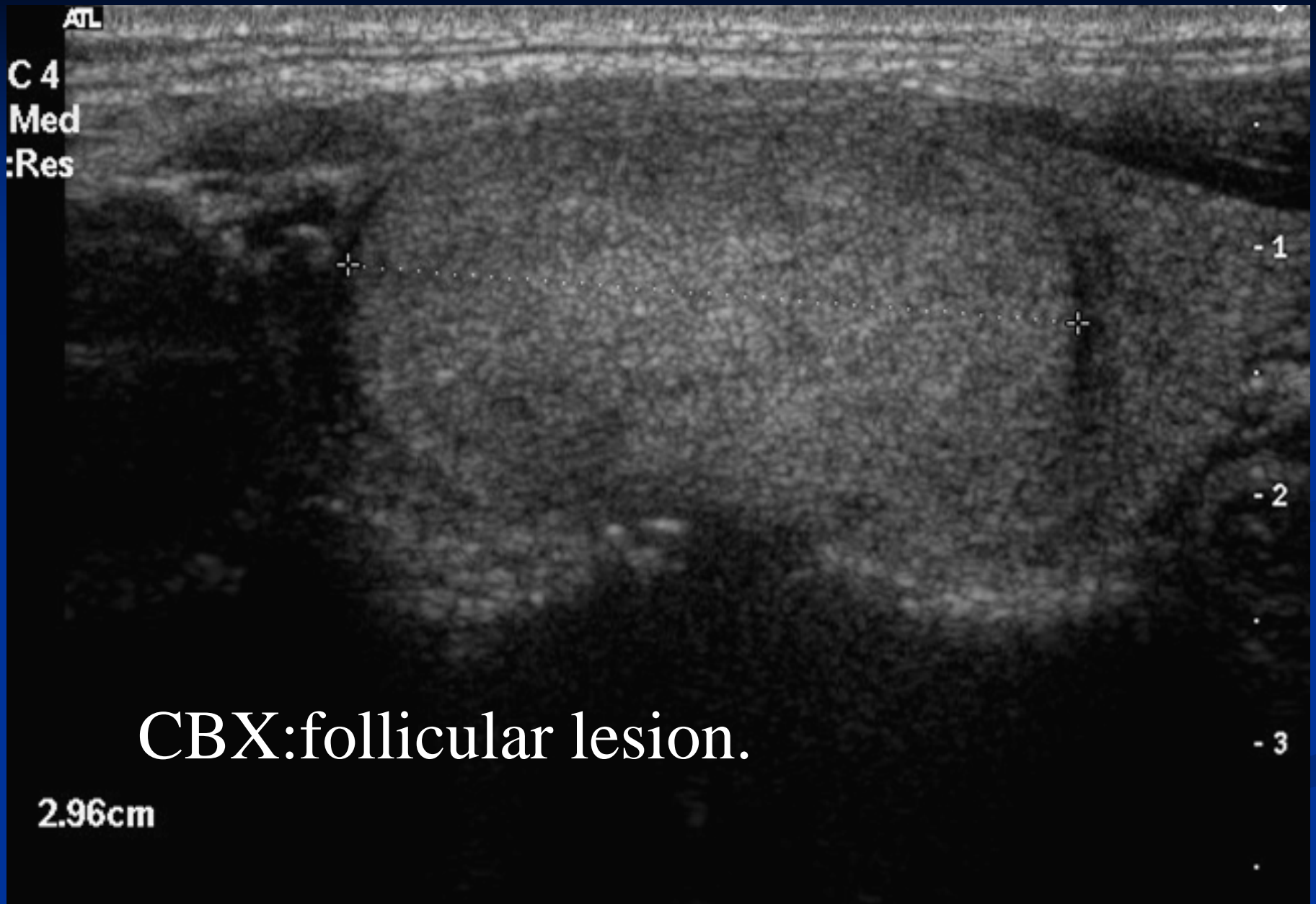
# Follicular lesions.

- Spectrum from adenoma to carcinoma.
- 80% will be benign
- Follicular carcinoma – 10-15% of all thyroid Ca.
- Cytology of no use.
- Histology of no use in differentiation.
- Surgical specimen : vascular and capsular invasion – follicular carcinoma.



Ultrasound :follicular lesion.

2.96cm

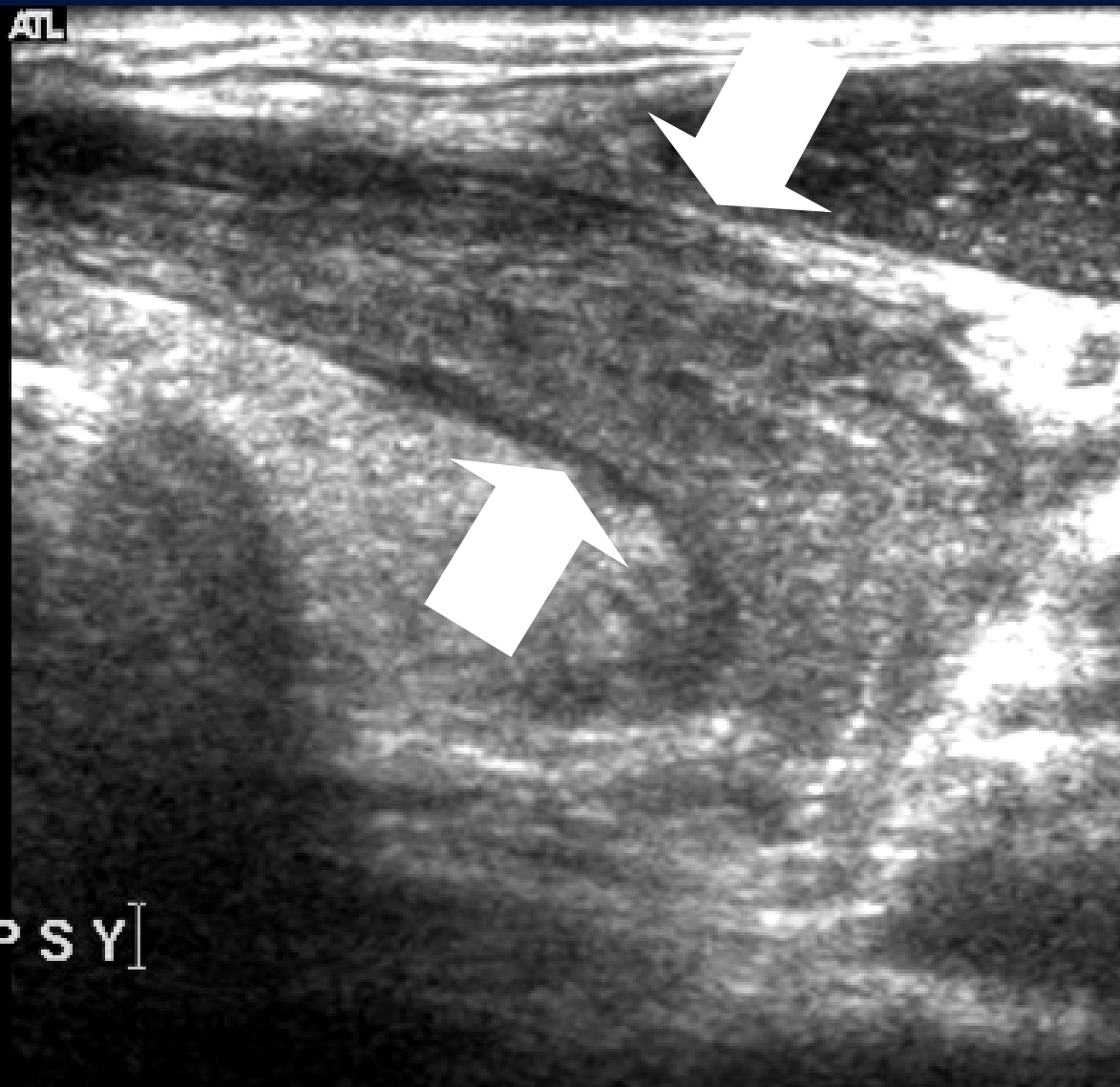


Map 3  
170dB/C 2  
Persist Off  
2D Opt:FSCT  
Fr Rate:Surv  
SonoCT™



POST BIOPSY

Map 3  
170dB/C 2  
Persist Off  
2D Opt:FSCT  
Fr Rate:Surv  
SonoCT™



POST BIOPSY

# Follicular lesions.

- Adenomas : solid,homogenous,iso/hyper-echoic.
- Well defined halo.
- Carcinoma : solid ,hypo-echoic areas within.

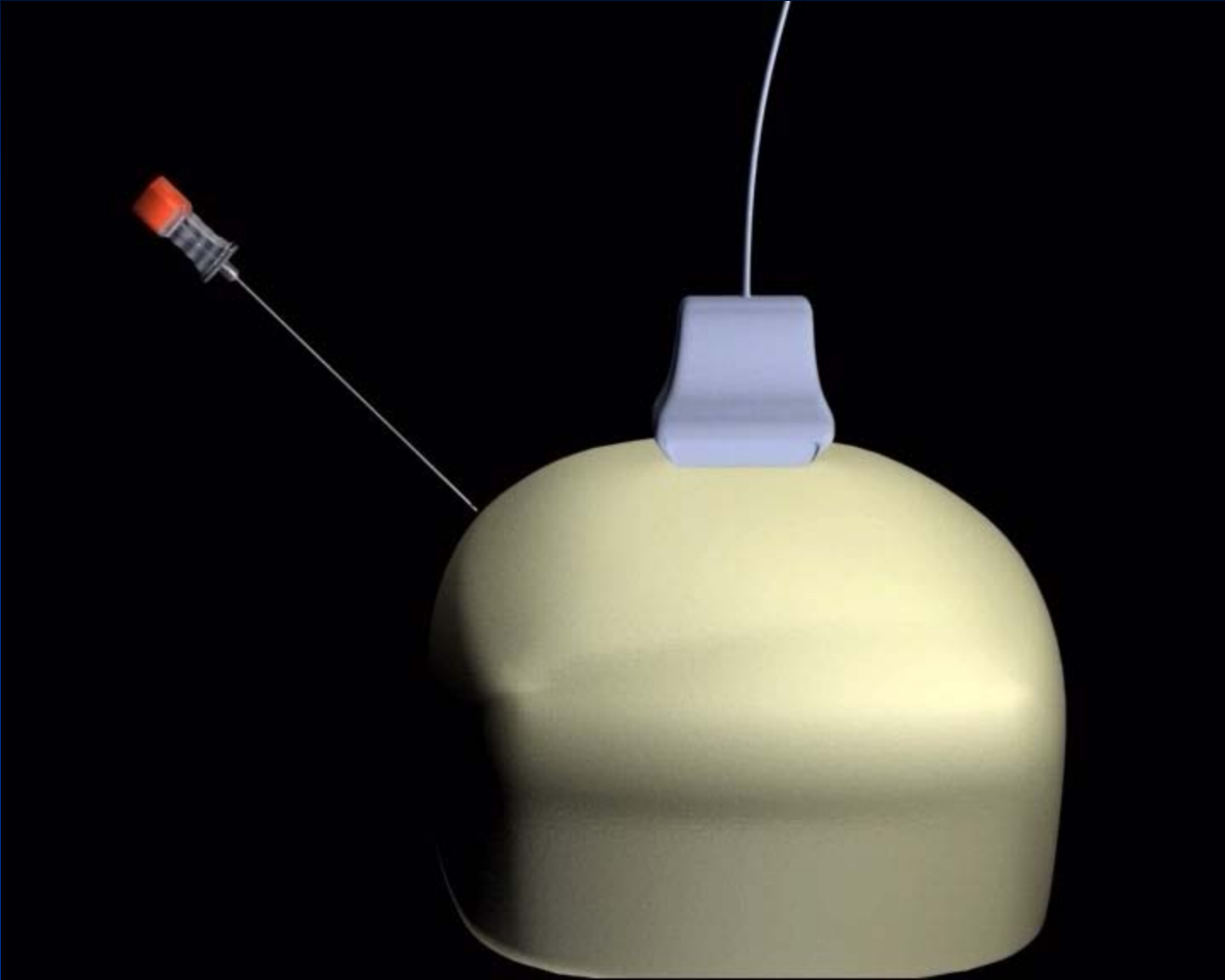
# Medullary carcinoma.



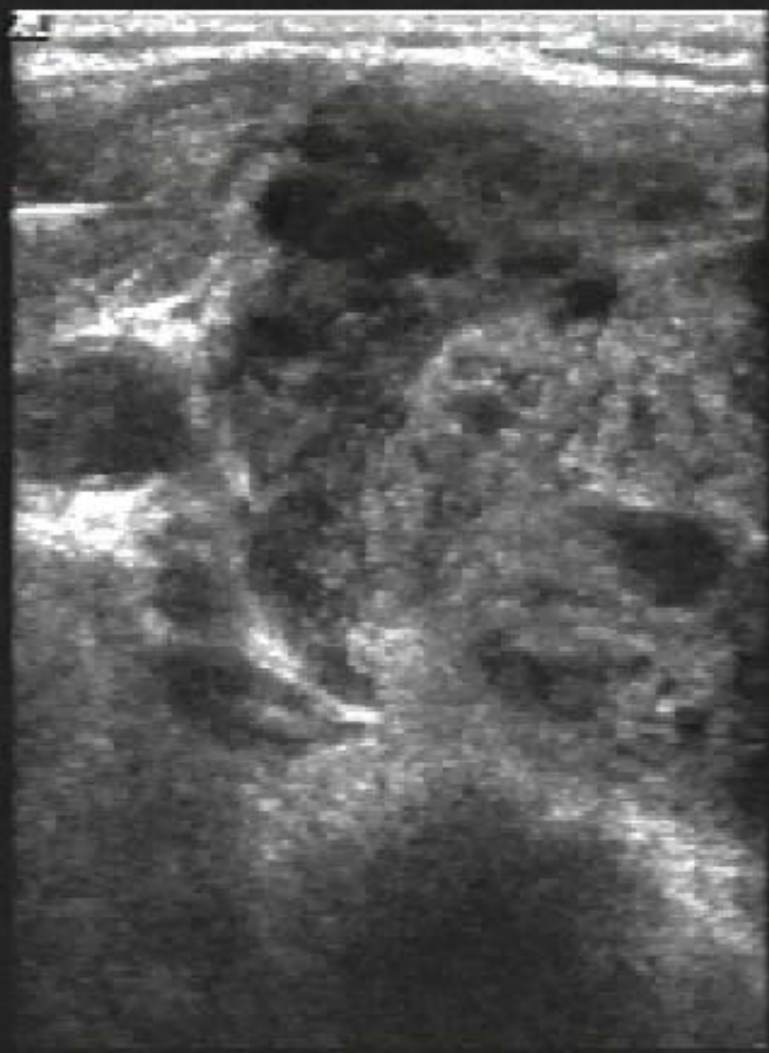
# Medullary Carcinoma Thyroid

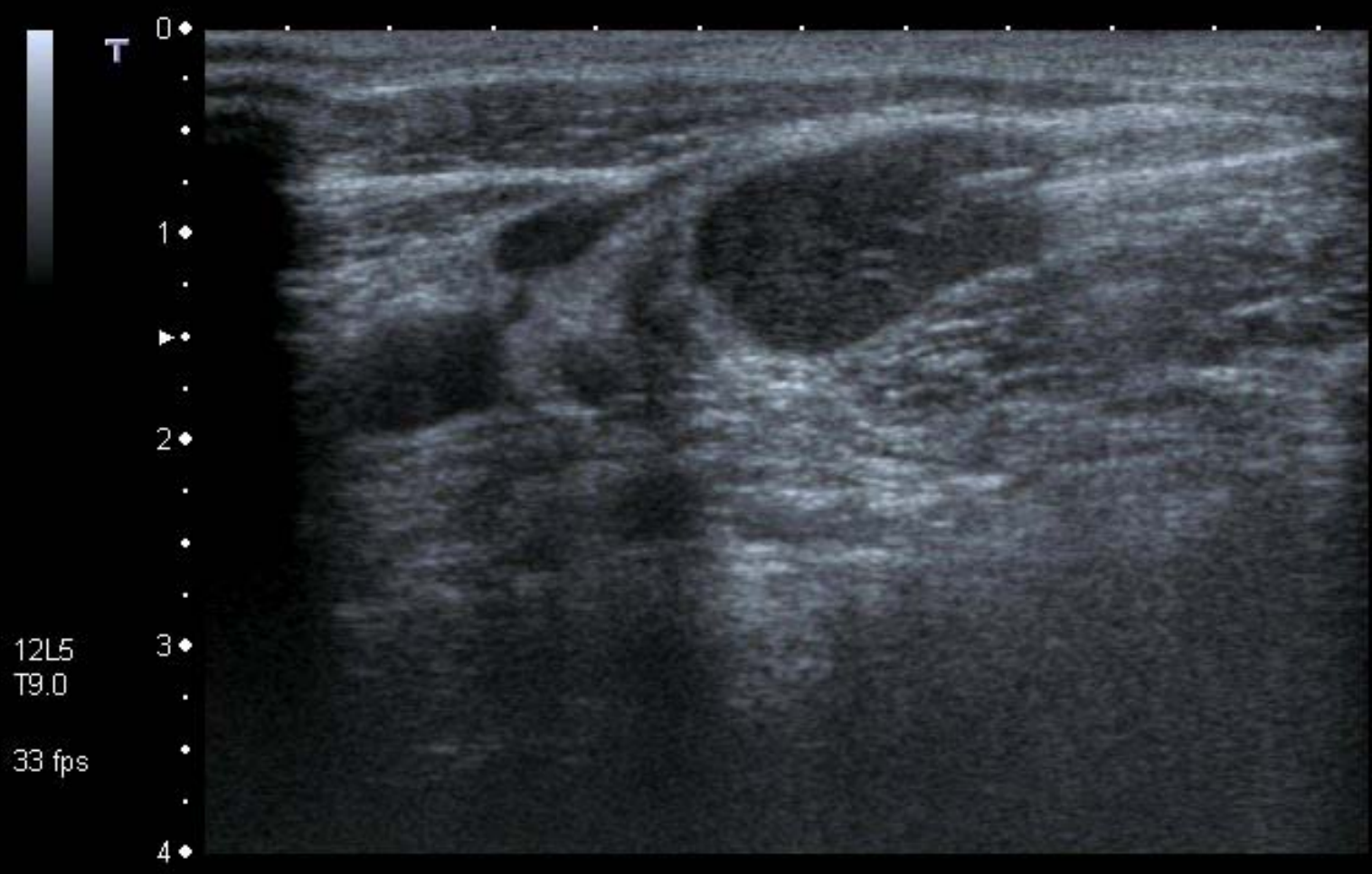
- Typically hypo-echoic.
- Contains calcification.
- Calcification more “globular”.
- “Calcification” may be amyloid.

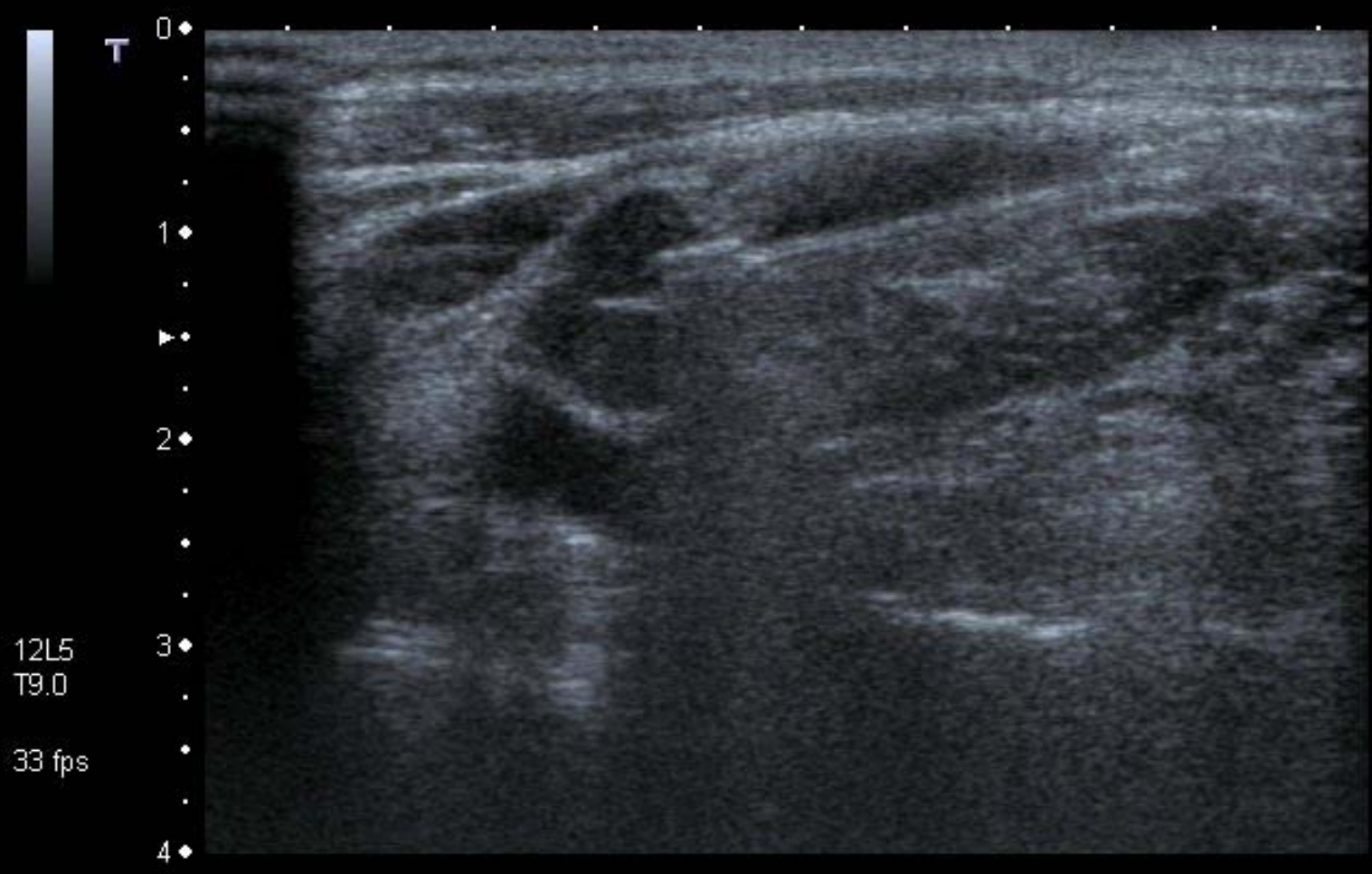




Map 3  
150dB/C2  
Persist Med  
2D OptRes  
BW 1 Pg 0  
Col 0 Pg 0







MI: 1.6

2DG  
80

DR  
70

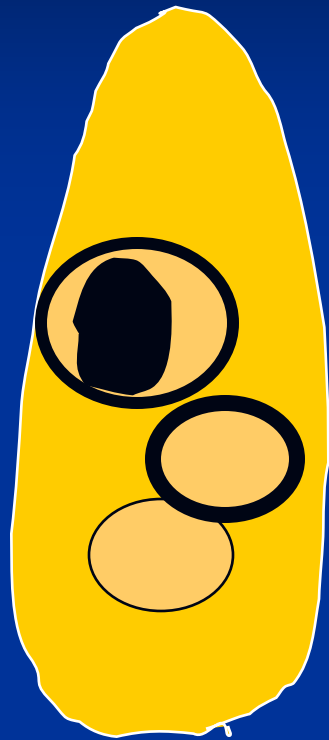
12L5  
T9.0  
33 fps

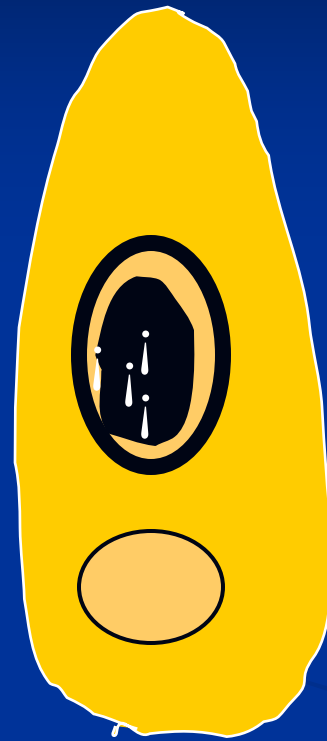
0 ♦  
.  
1 ♦  
.  
2 ♦  
.  
3 ♦  
.  
4 ♦

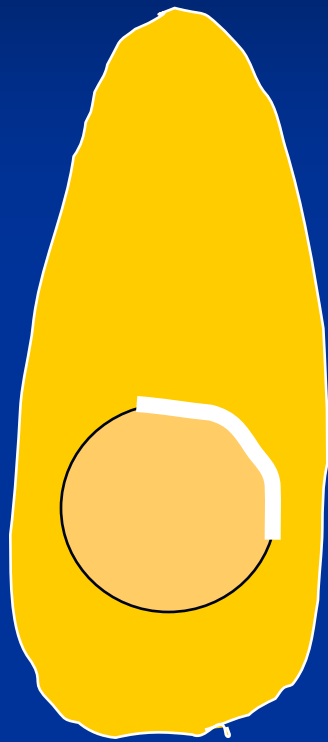
Signs?

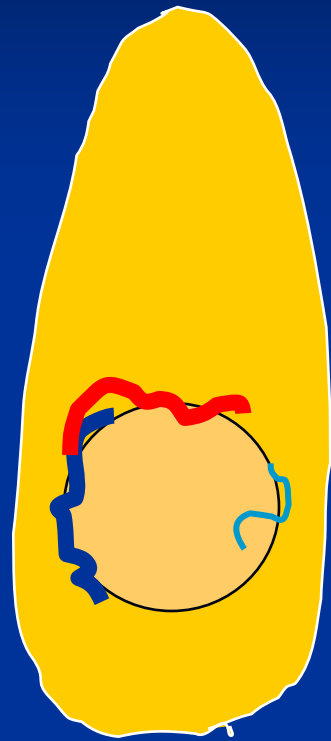


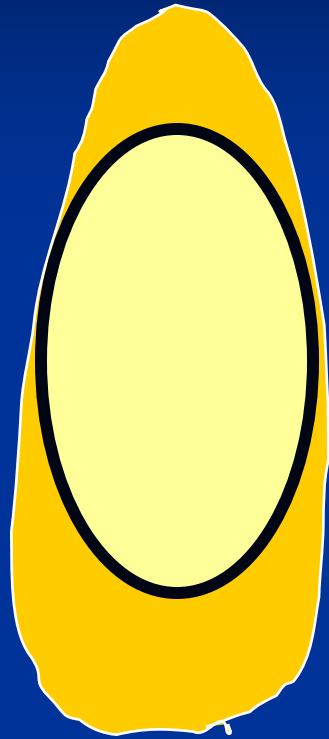




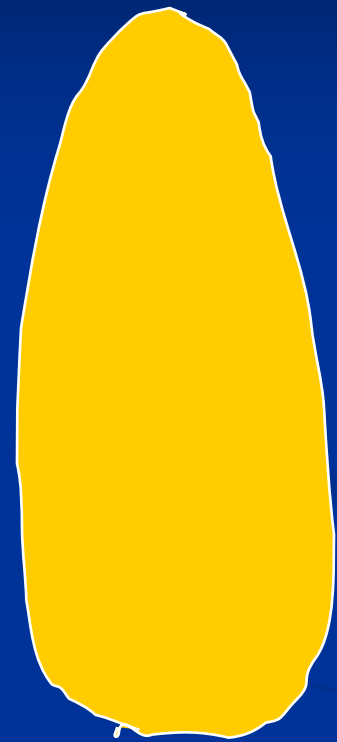


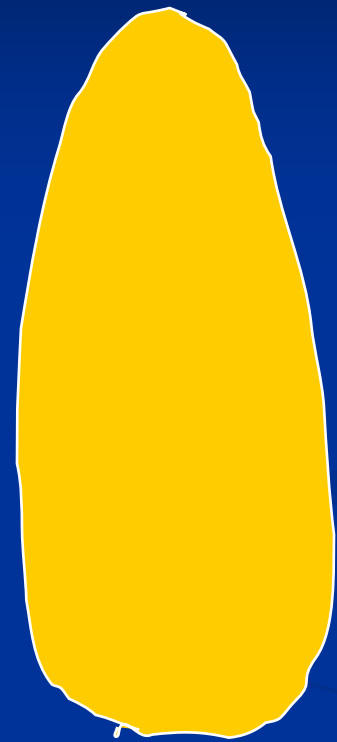




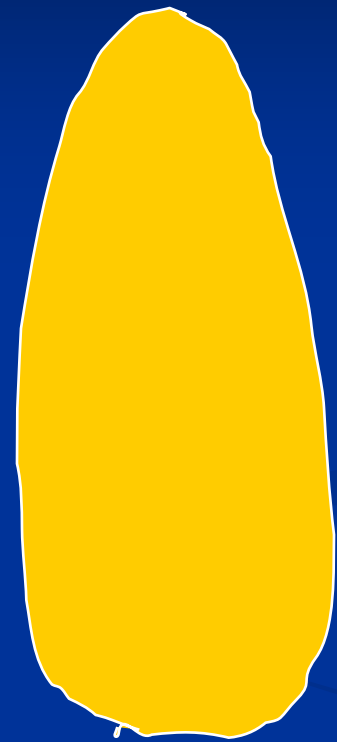


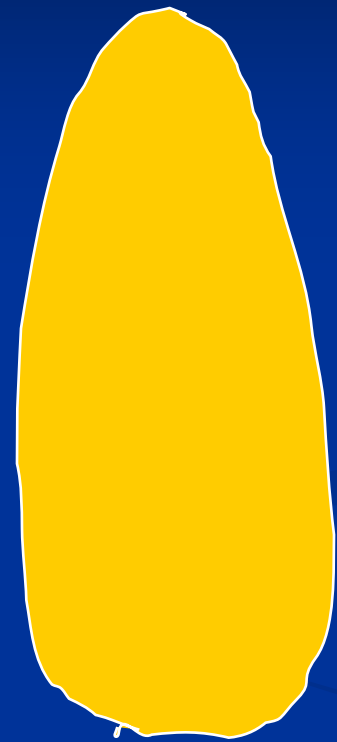














# Predictors of Cancer.

	Sensitivity	Specificity
■ Micro-calcifications	40%	90%
■ Absence of halo	66%	46%
■ Irregular margins	64%	84%
■ Hypo-echoic	83%	49%
■ Intra-nodular flow	70%	65%
■ MicroCa. & irreg m.	30%	95%
■ MicroCa. & hypoechoic	28%	95%
■ Solid & hypoechoic	73%	69%

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# Thyroid nodules.

- Sorting out nodules.
- Learn from others – Breast Radiologists.
- R Classification.
- Cytological classification(1 -5)
- Clinical scenario.
- Correctly manage patient.

# Breast nodules – R classification..

**R**

1 : Normal.

2 : Probably benign.

3 : Indeterminate.

4 : Suspicious.

5 : Malignant

# Nodules – R classification.....thyroid?

**R**

1 : Normal.

2 : Probably benign.

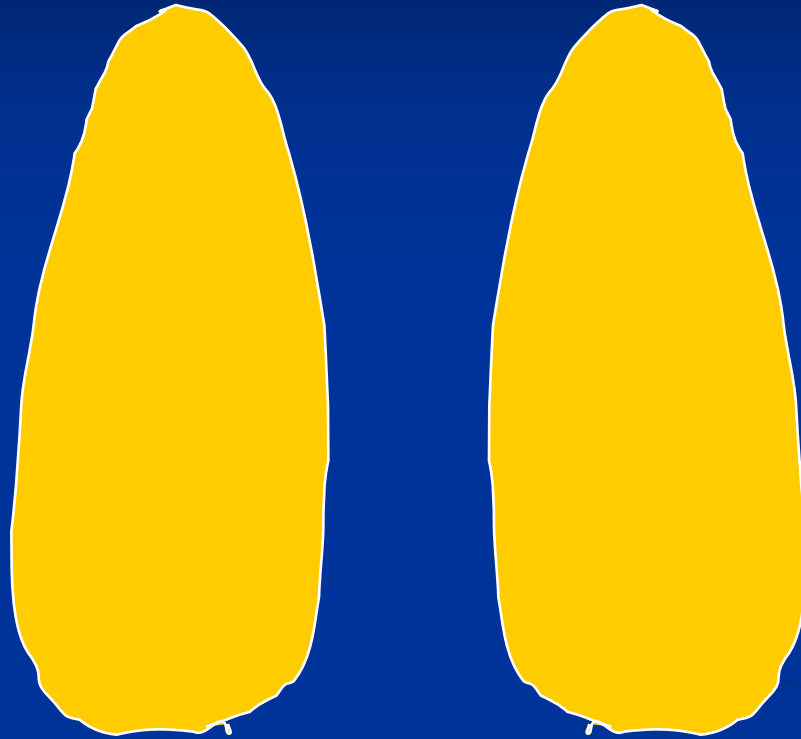
3 : Indeterminate.

4 : Suspicious.

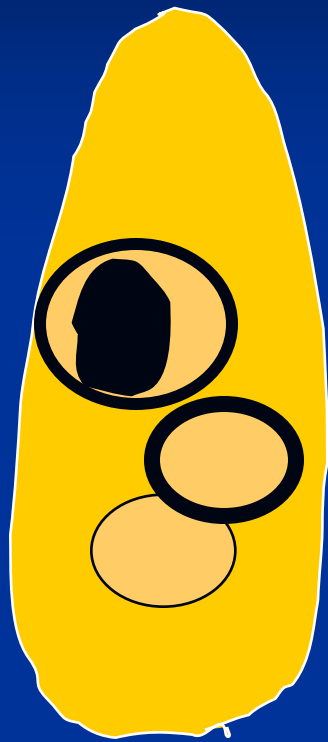
5 : Malignant



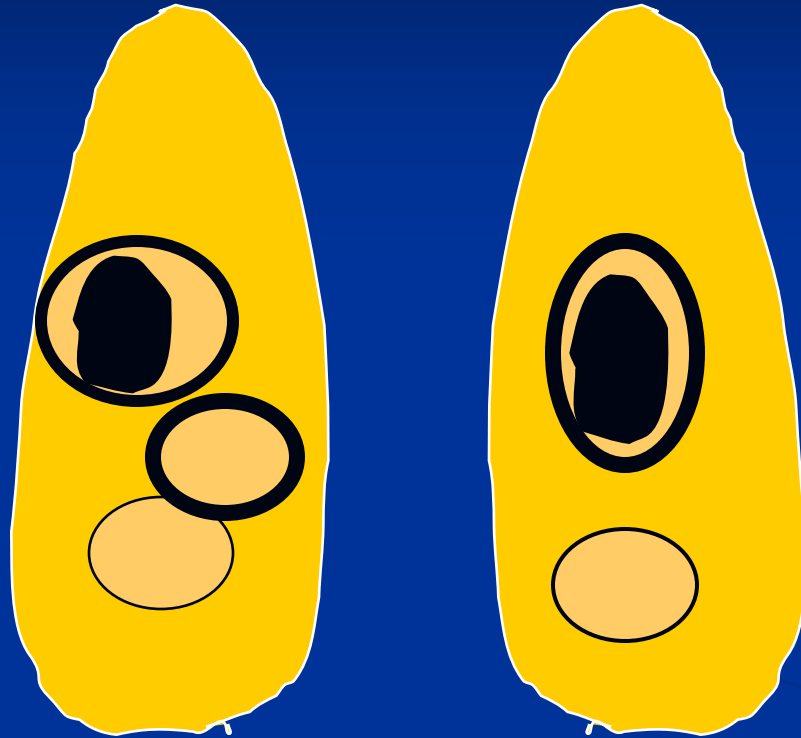
R 1





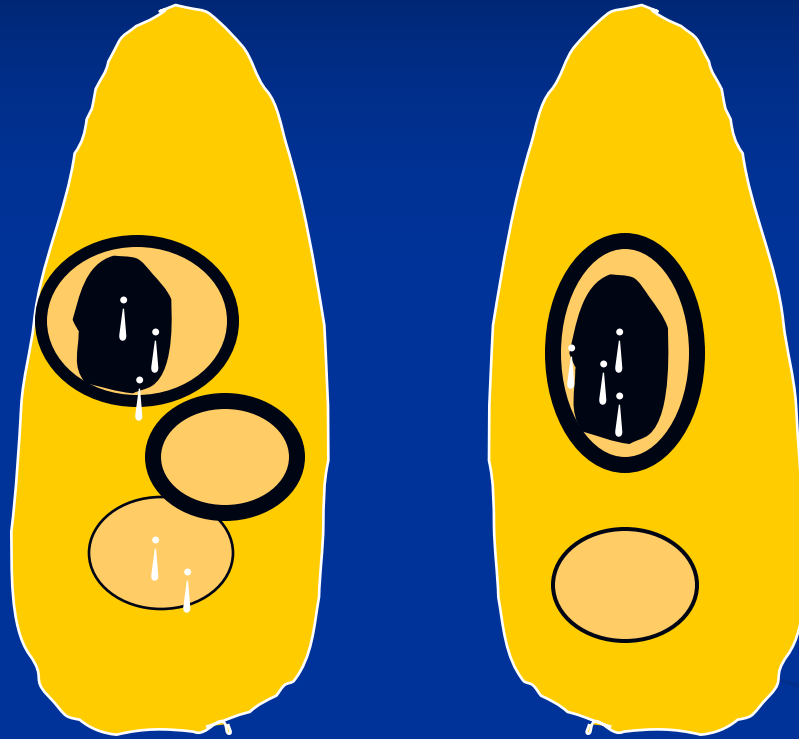


R 2

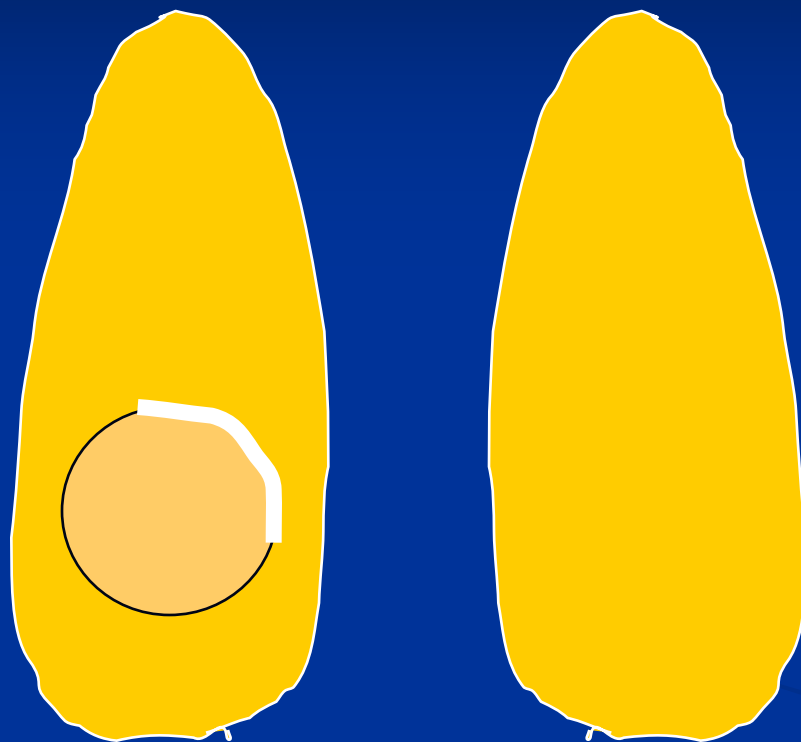




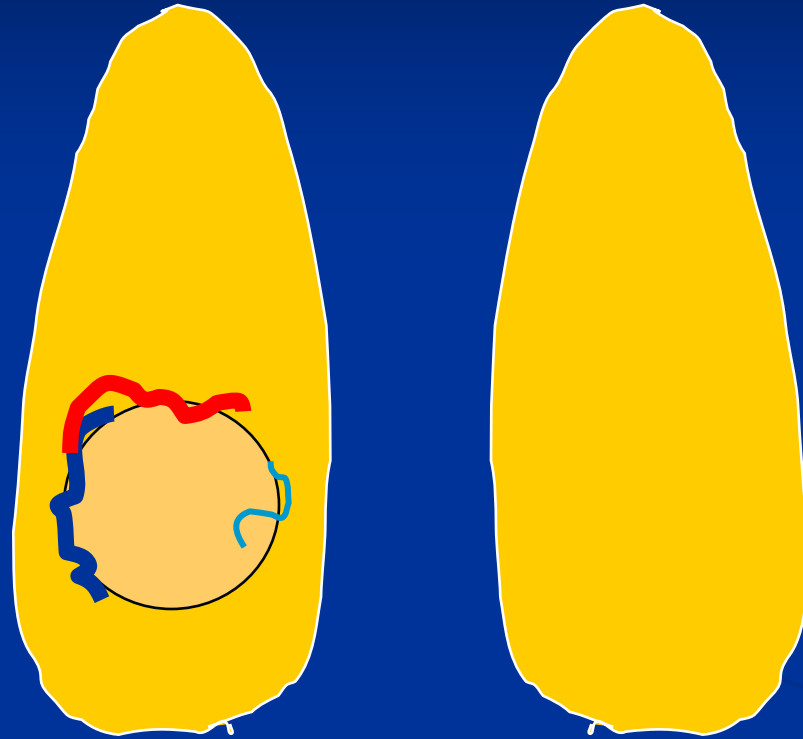
R 2

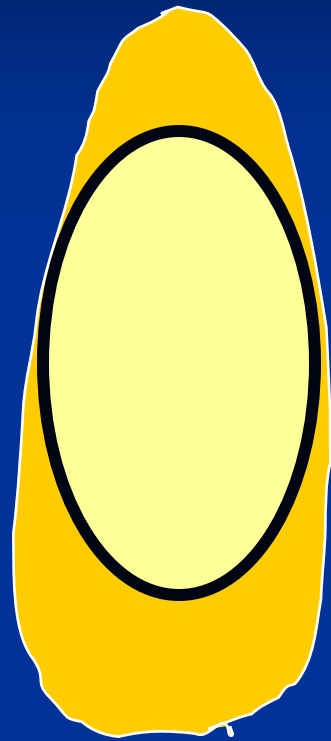


R 2

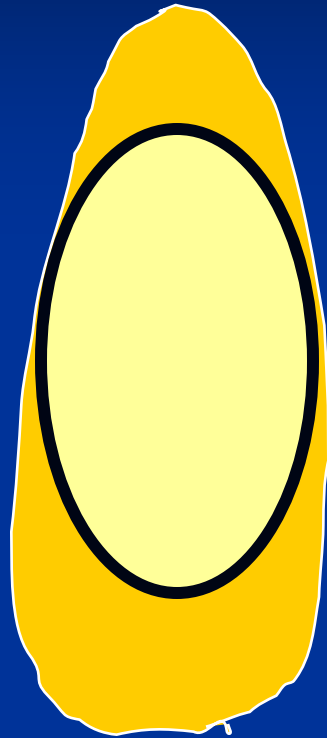


R 2





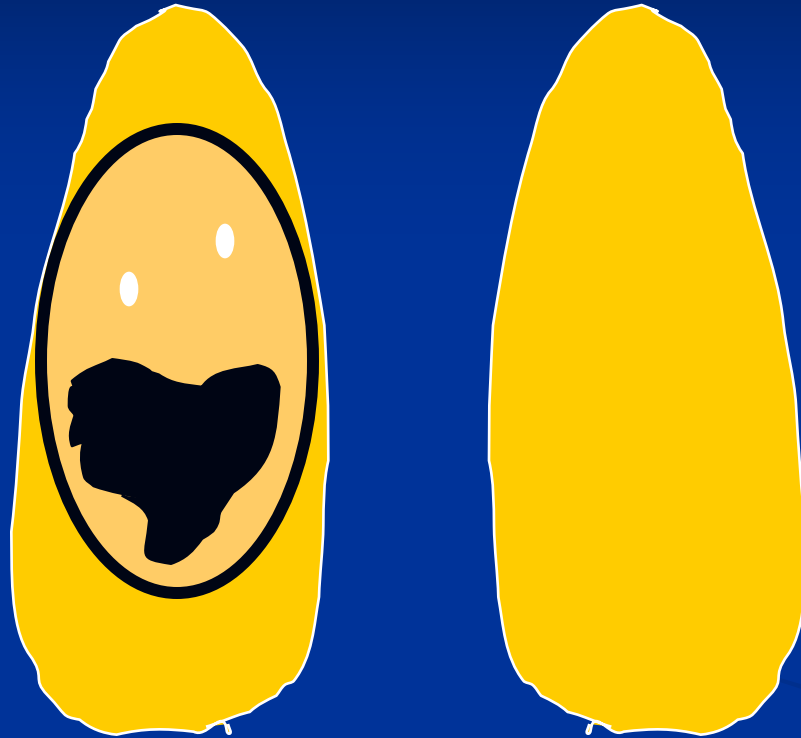
R 3



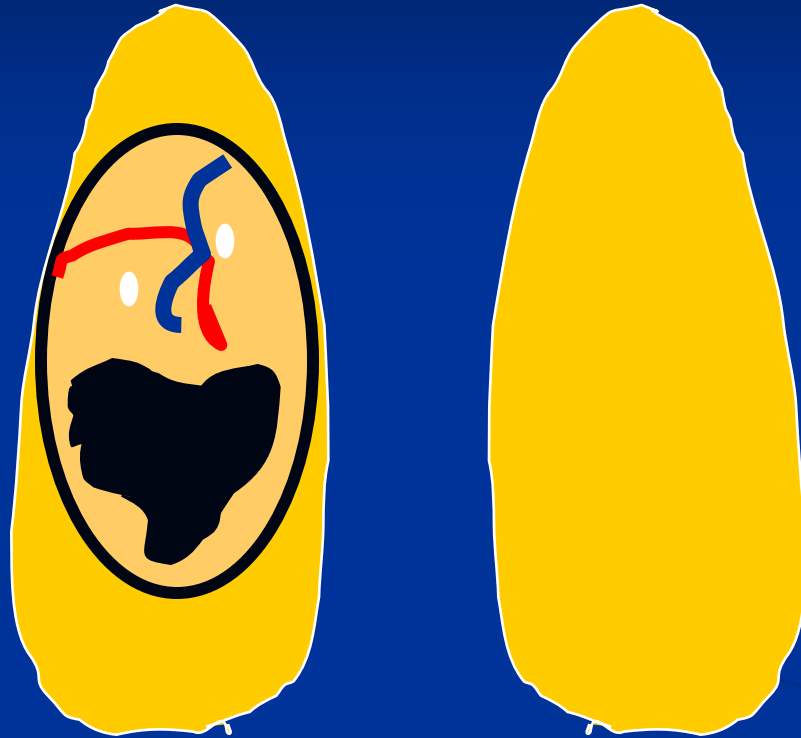




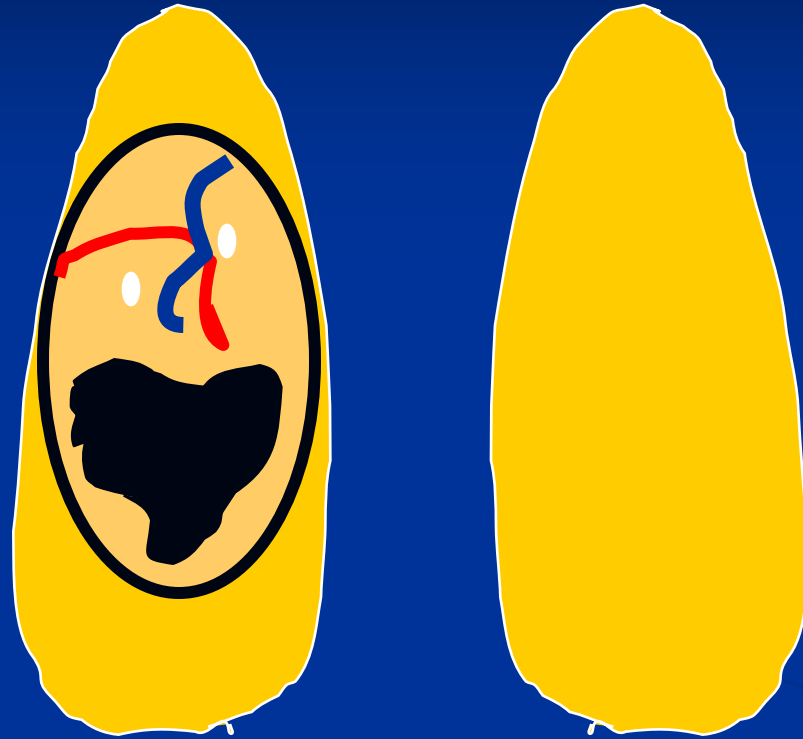
R ?



R ?

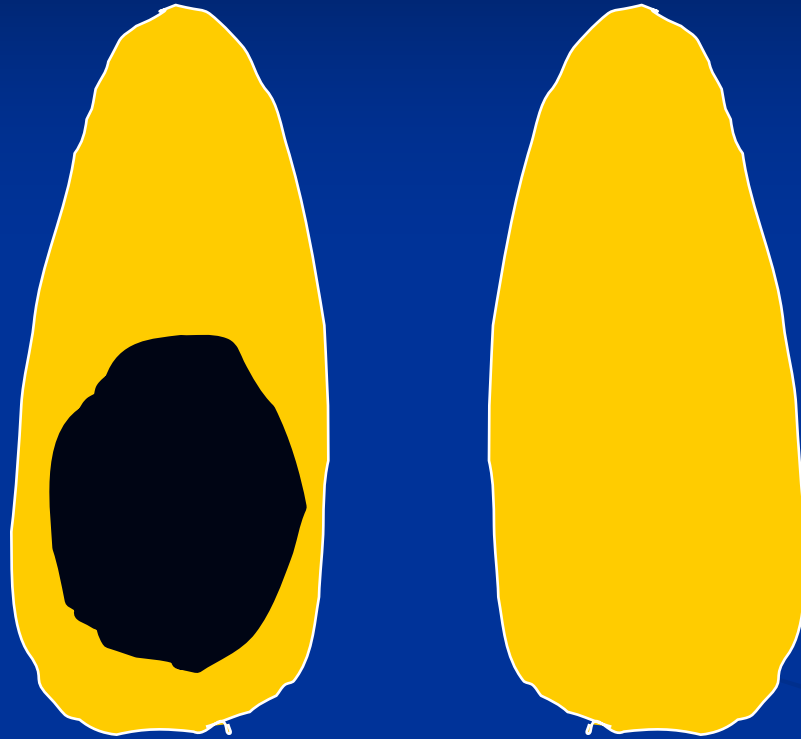


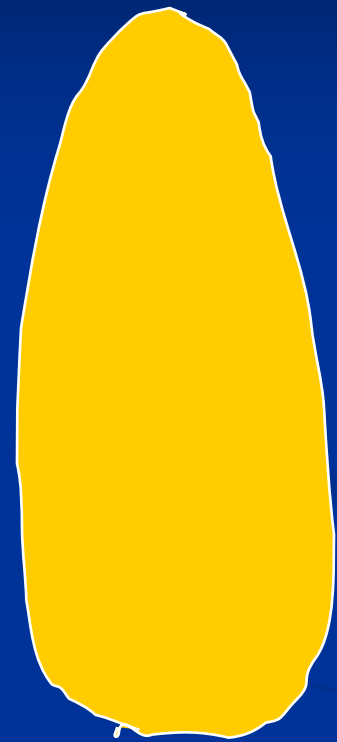
R 3





R 4

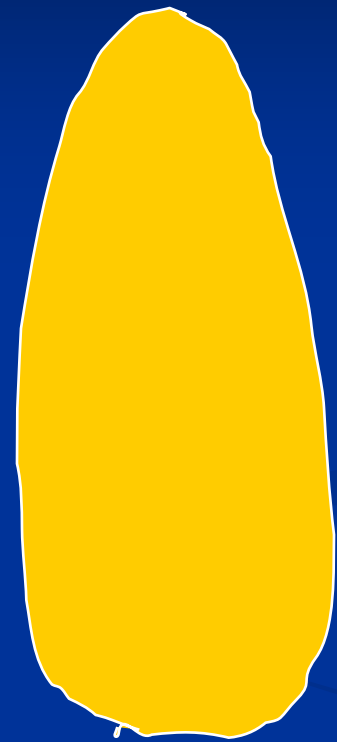




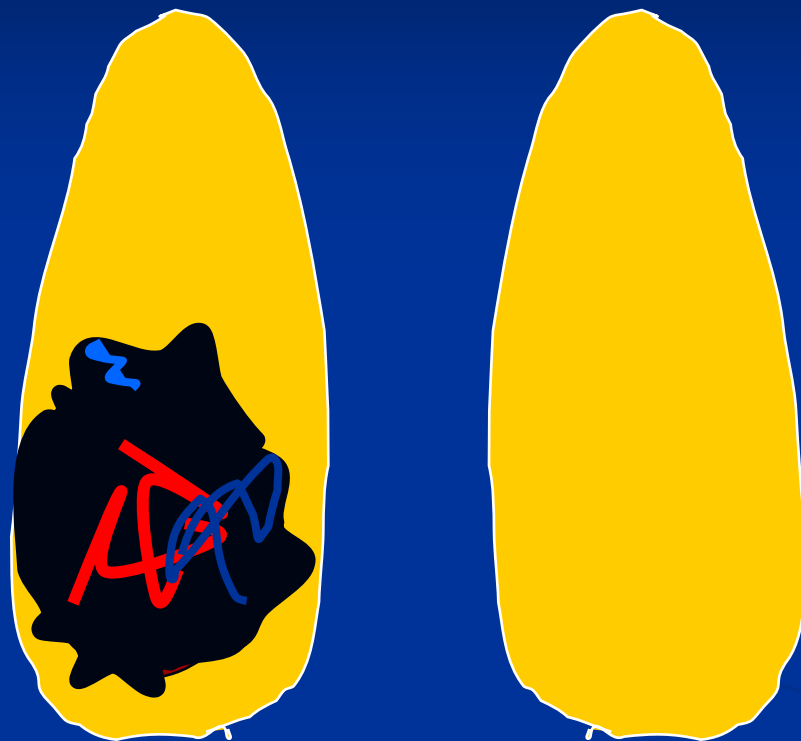
**R 4/5**

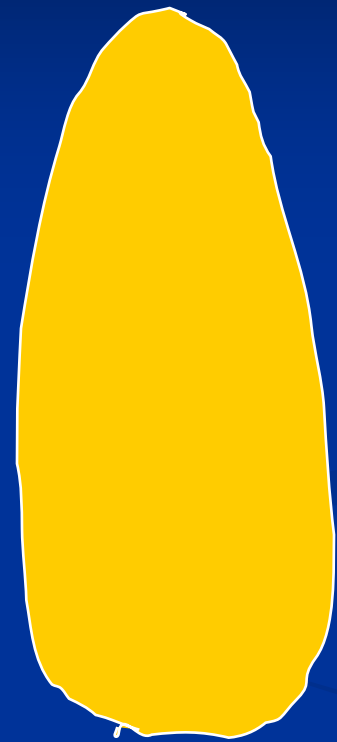
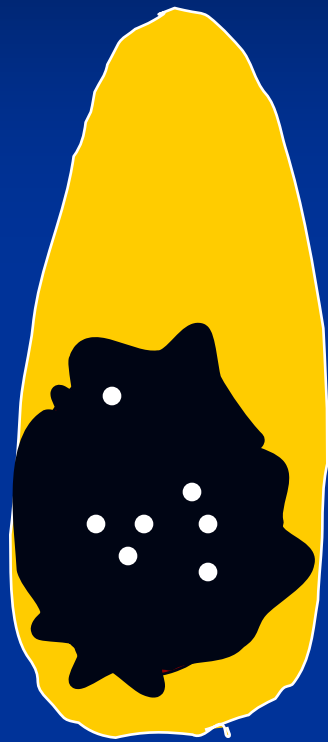




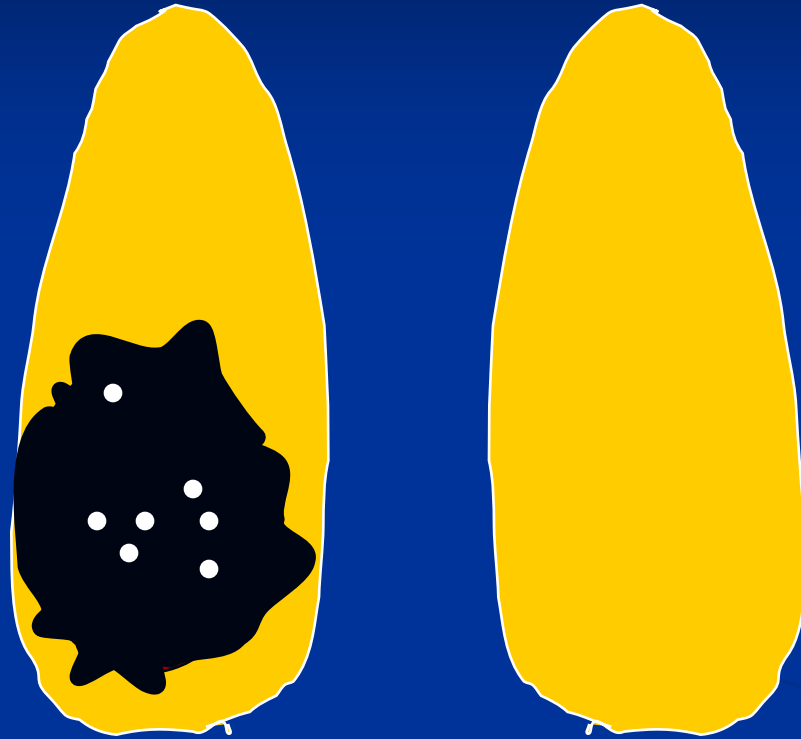


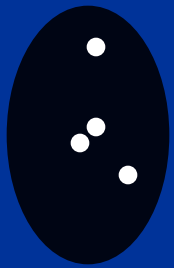
R 5





R 5



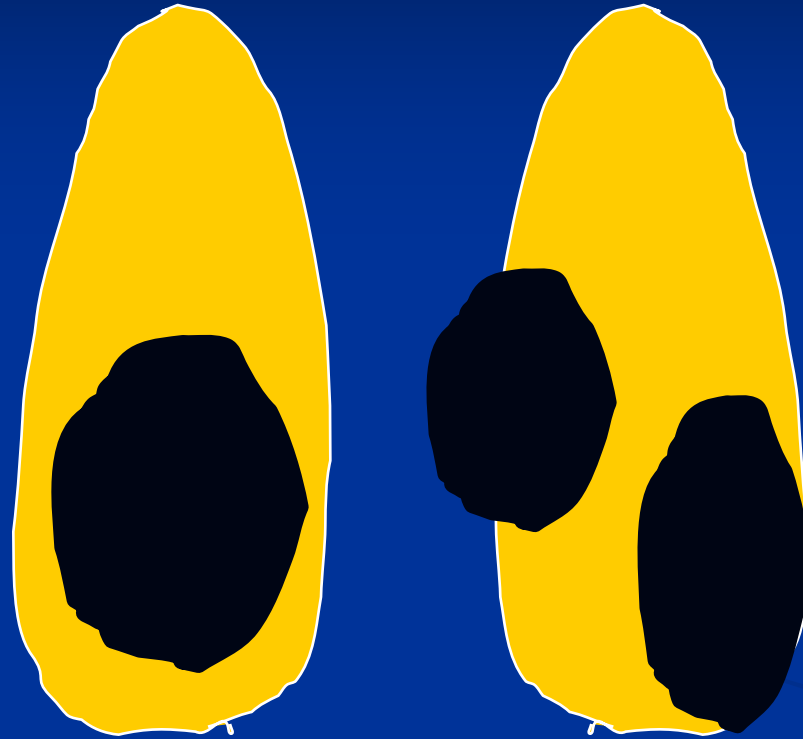


R 5



Lymphoma

R 5



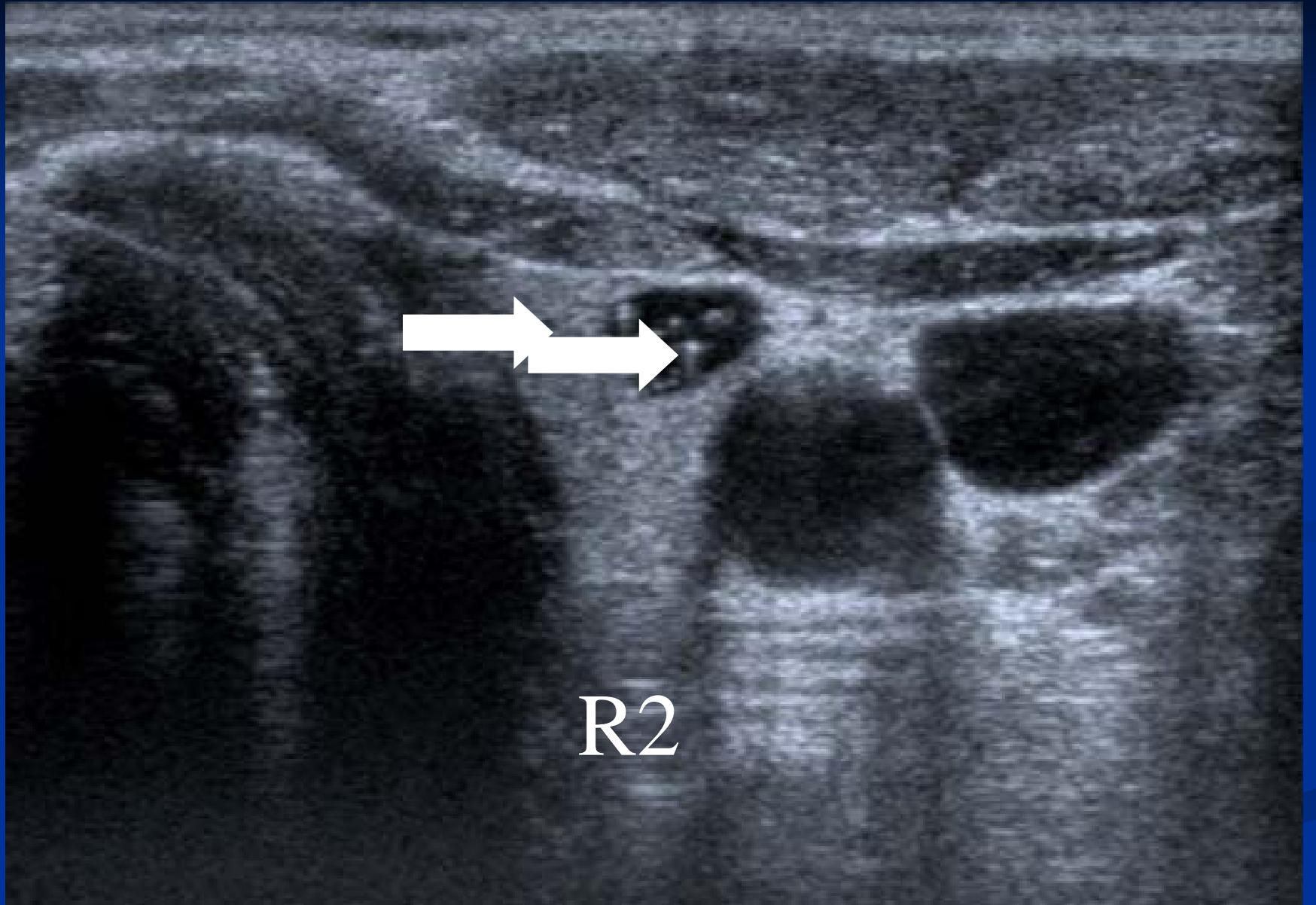
Metastases

# Thyroid nodules.

- R Classification.
- Cytological classification(1 -5)
- Clinical scenario.
- Correctly manage patient.



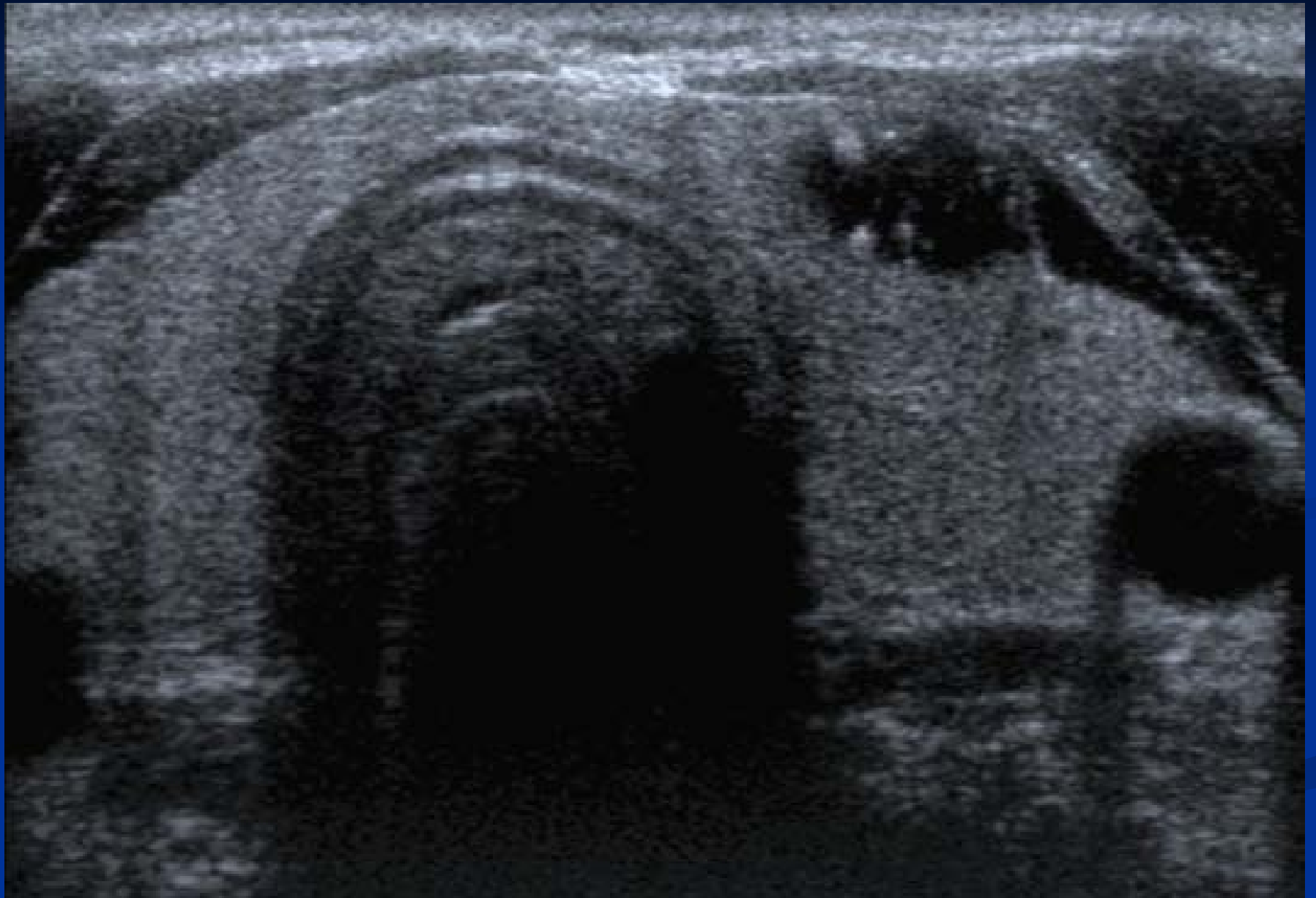
# Case 1.

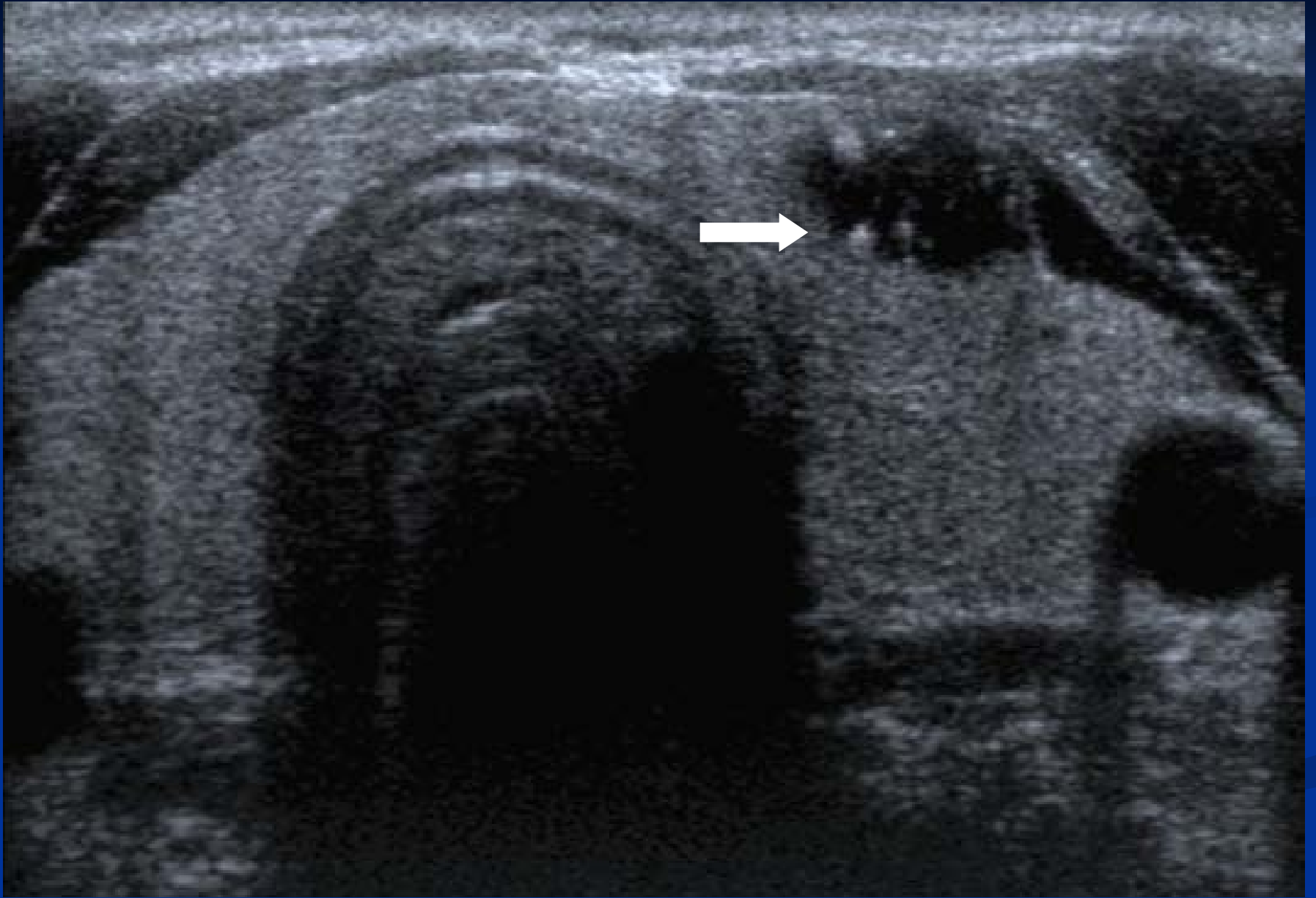


R2

# Case 2.







**R 2 or 3?**





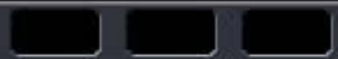
0 ◆  
1 ◆  
2 ◆  
3 ◆  
4 ◆



MI:1.6  
2DG  
93  
DR  
70

12L5  
T9.0

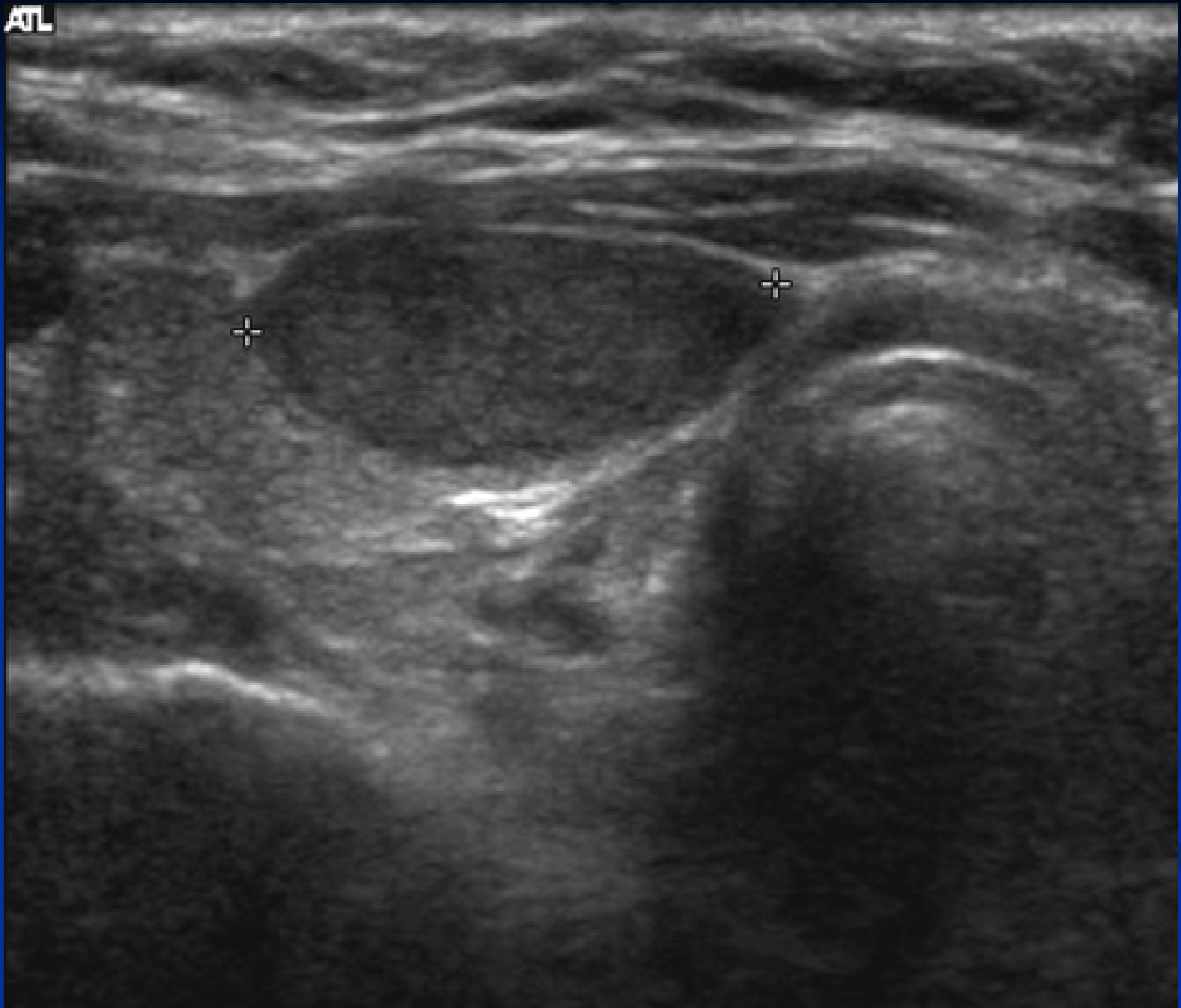
33 fps



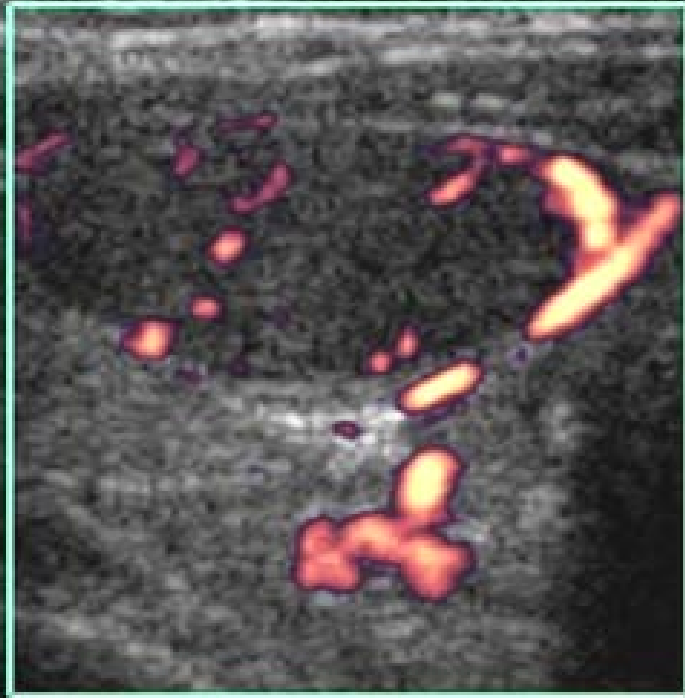


# Case 3.

ATL



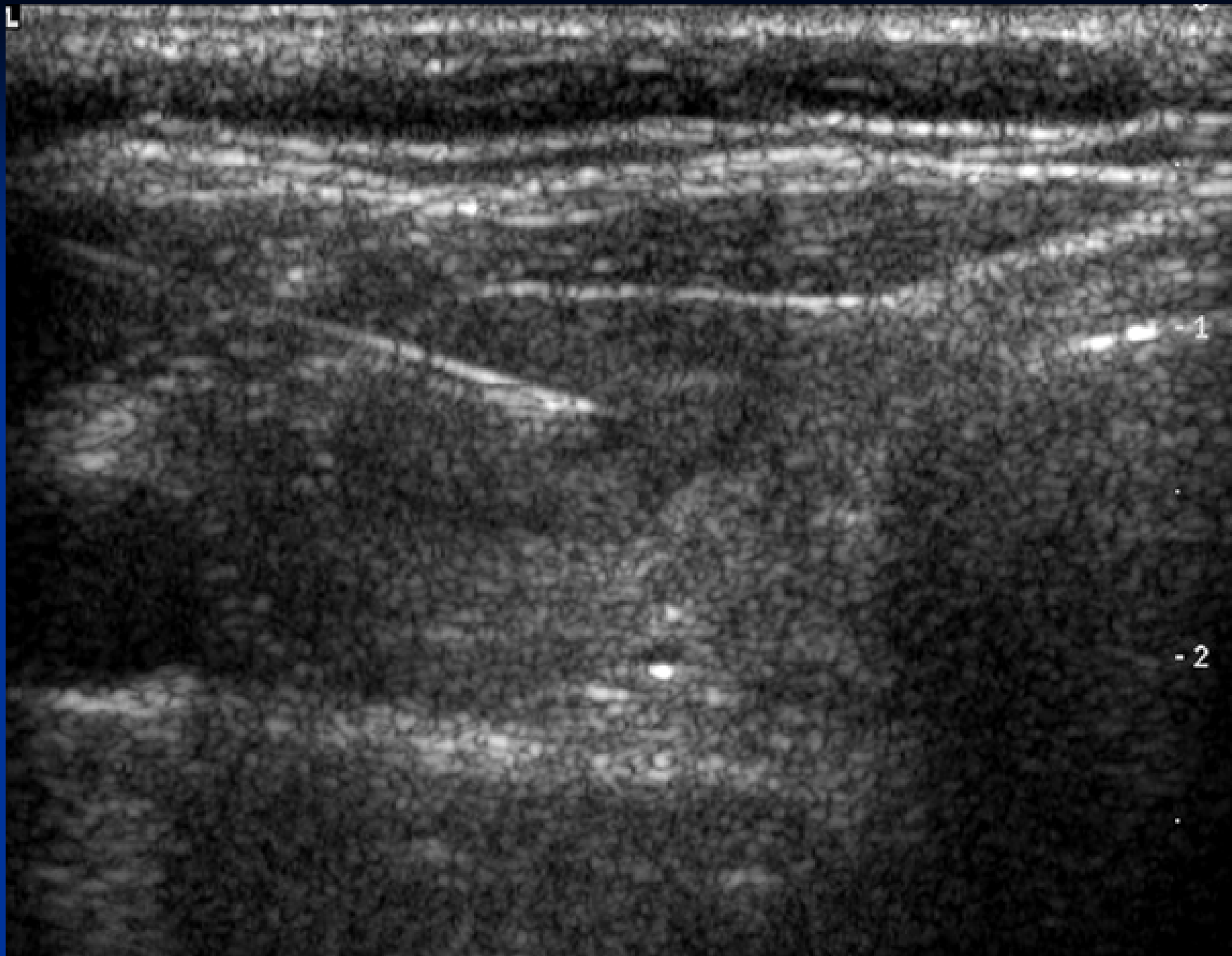
ATL



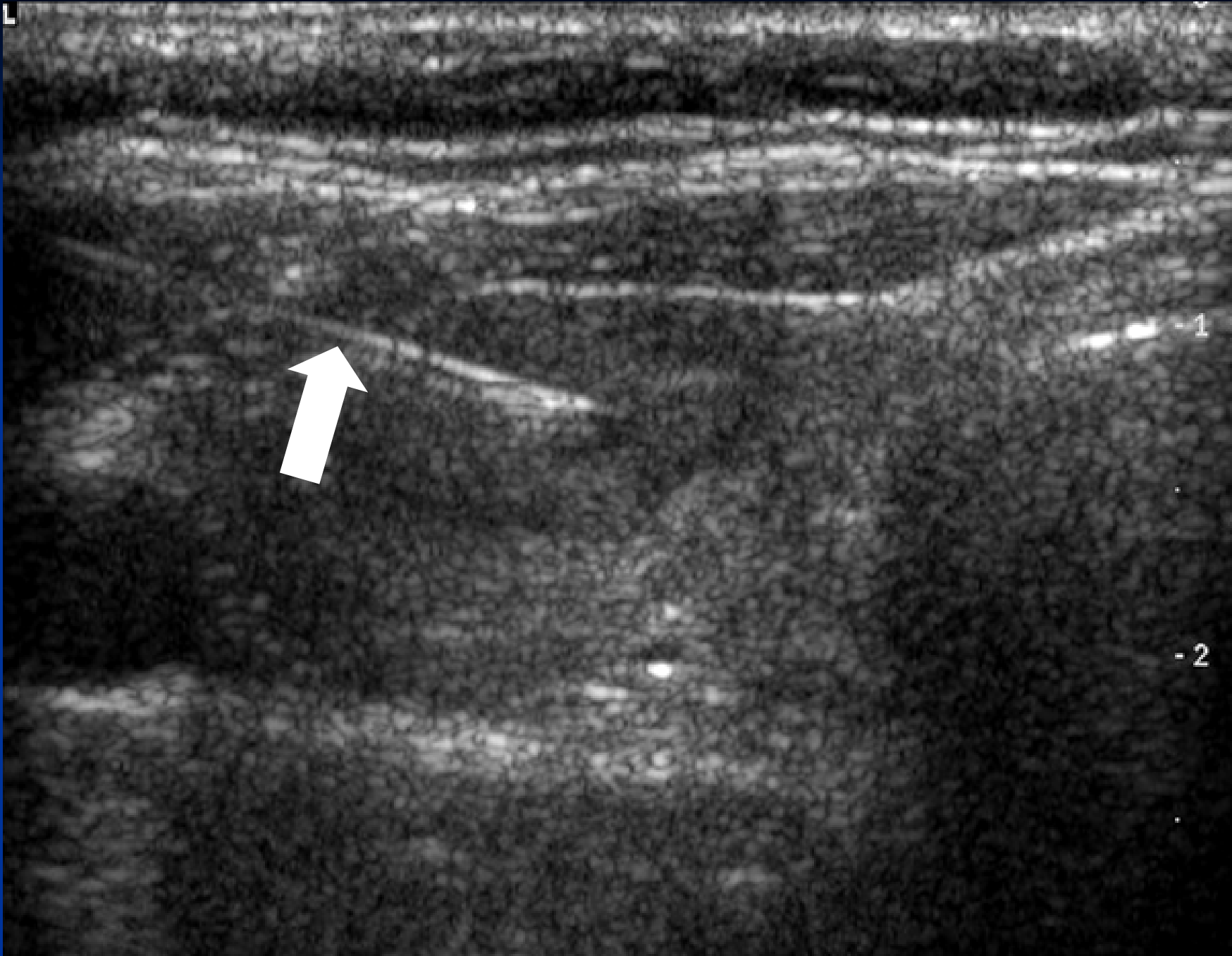
ATL

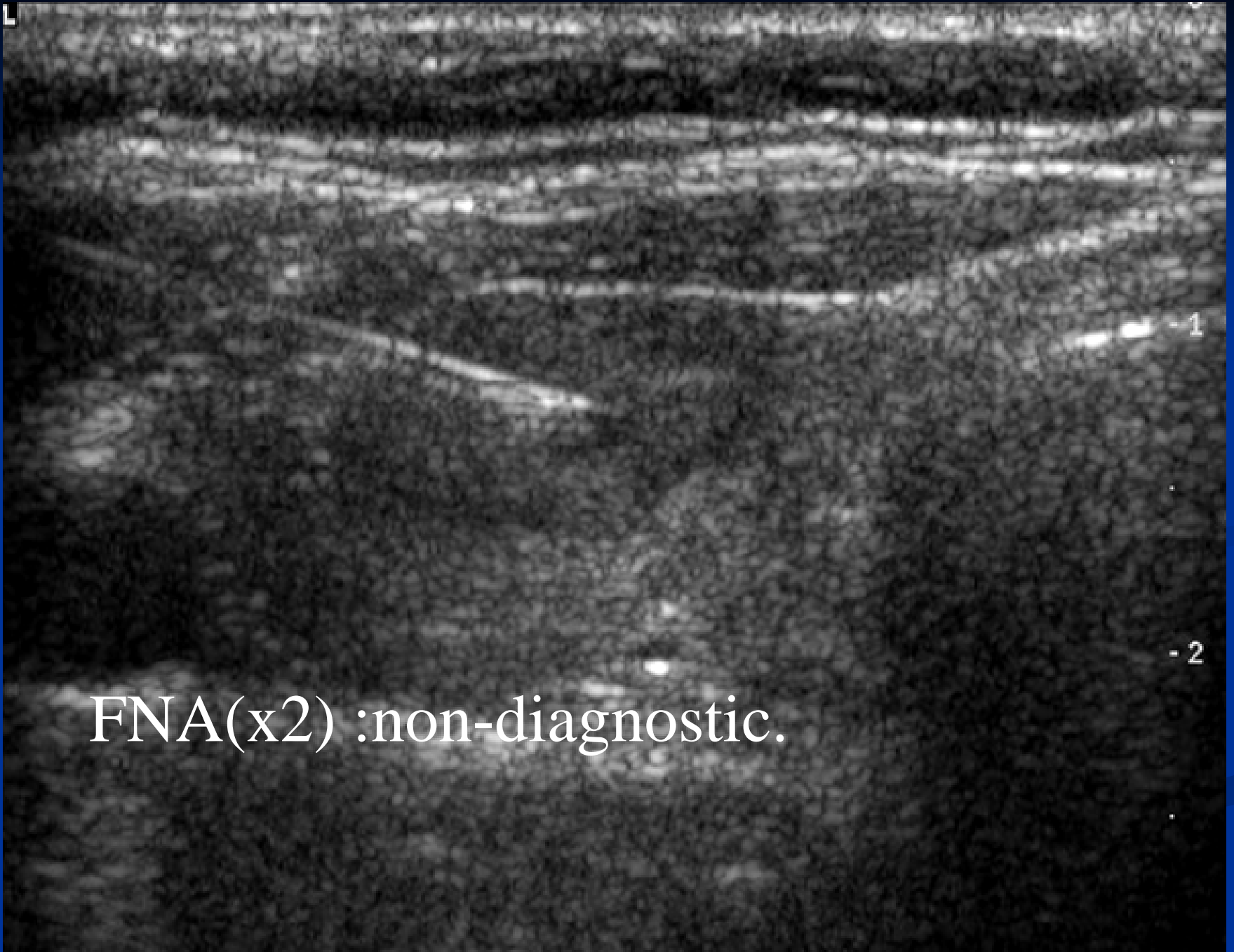
R 4





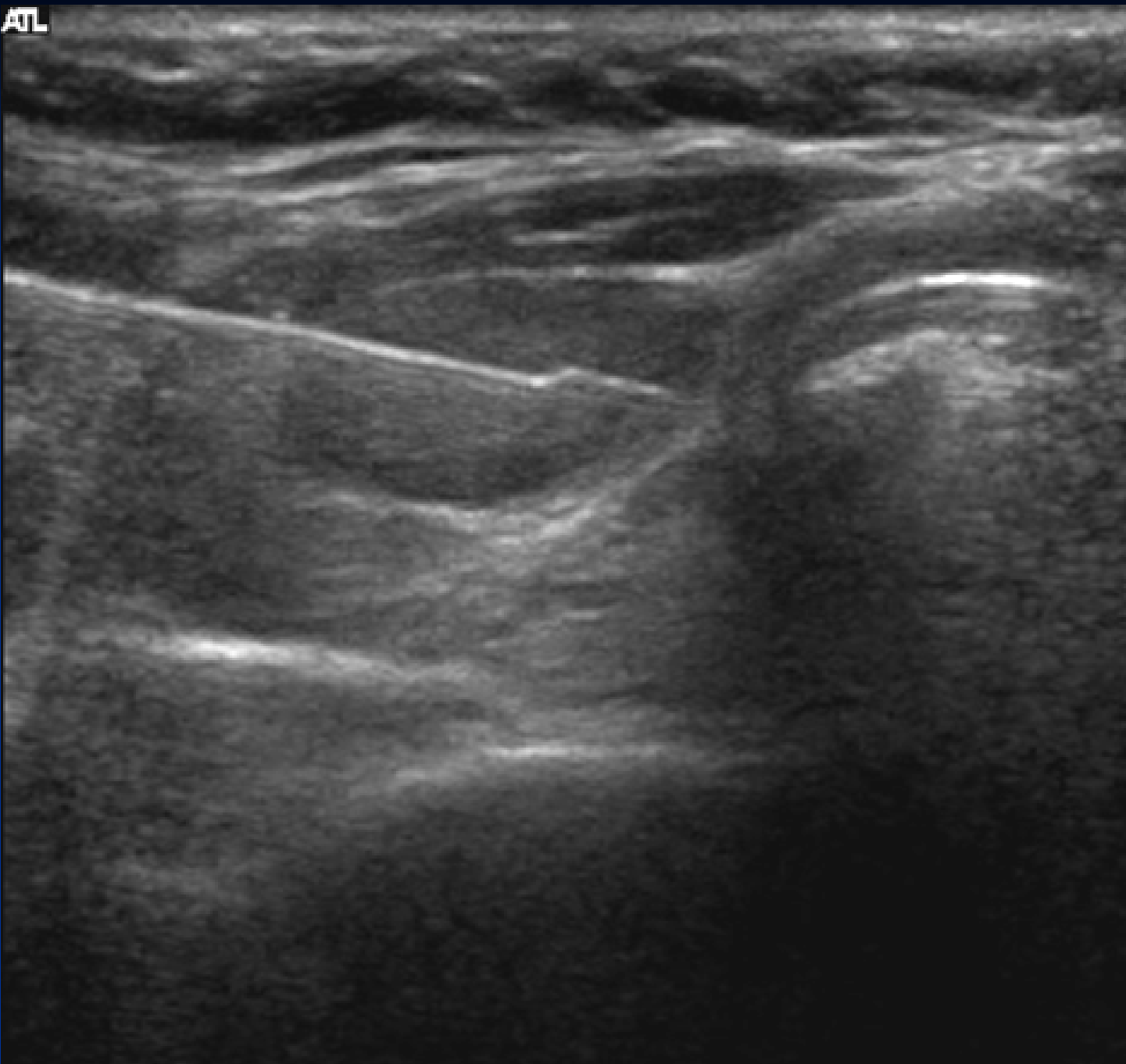
L





FNA(x2) :non-diagnostic.

ATL





ATL



ATL



CBX: No features of malignancy, probable colloid nodule.

# Case 4.

APure



0 ♦ T

2 ♦

▶ ♦

4 ♦

12L5  
T9.0

18 fps

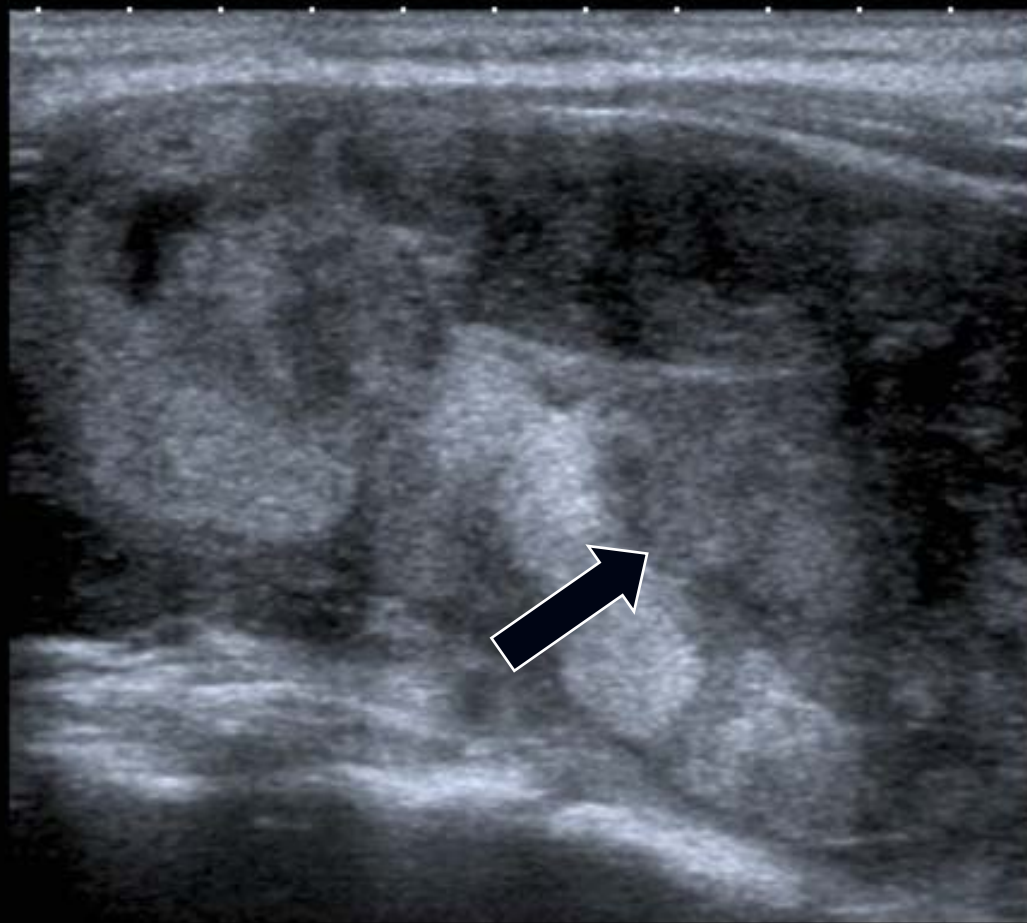


2DG  
88  
DR  
70



APure

0 ♦ T  
2 ♦  
4 ♦  
12L5  
T9.0  
18 fps



2DG  
88  
DR  
70

APure

R 4

5.8



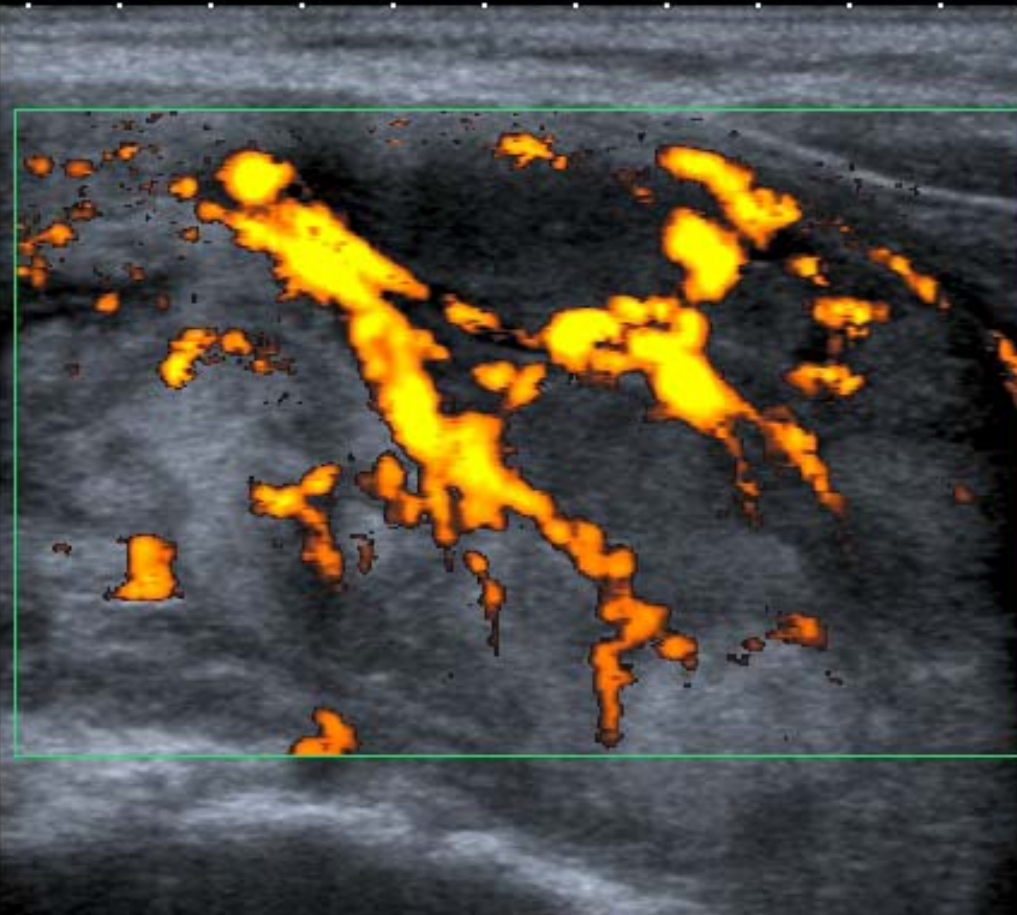
0 ♦ T

2 ♦

▶

▼

4 ♦

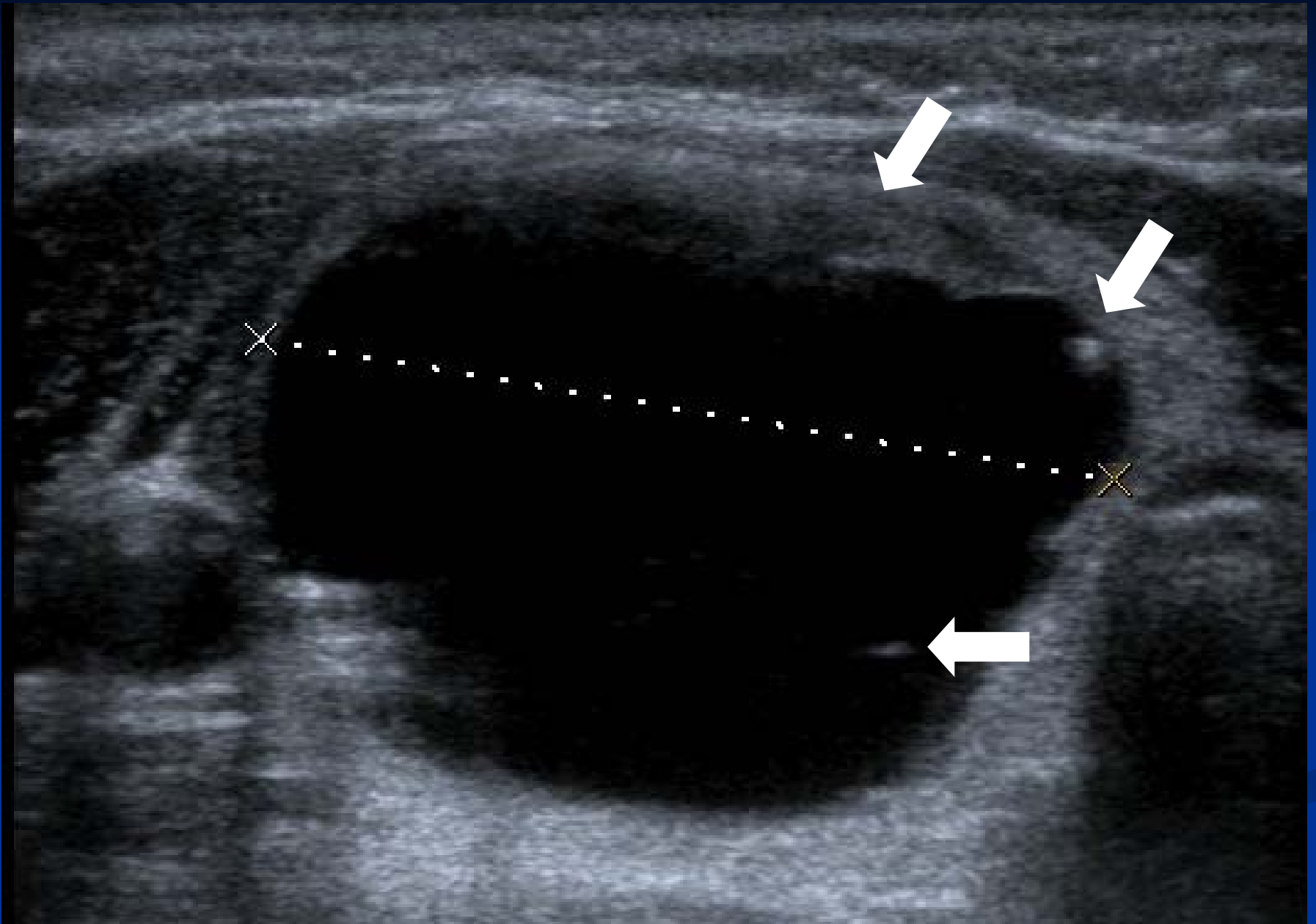


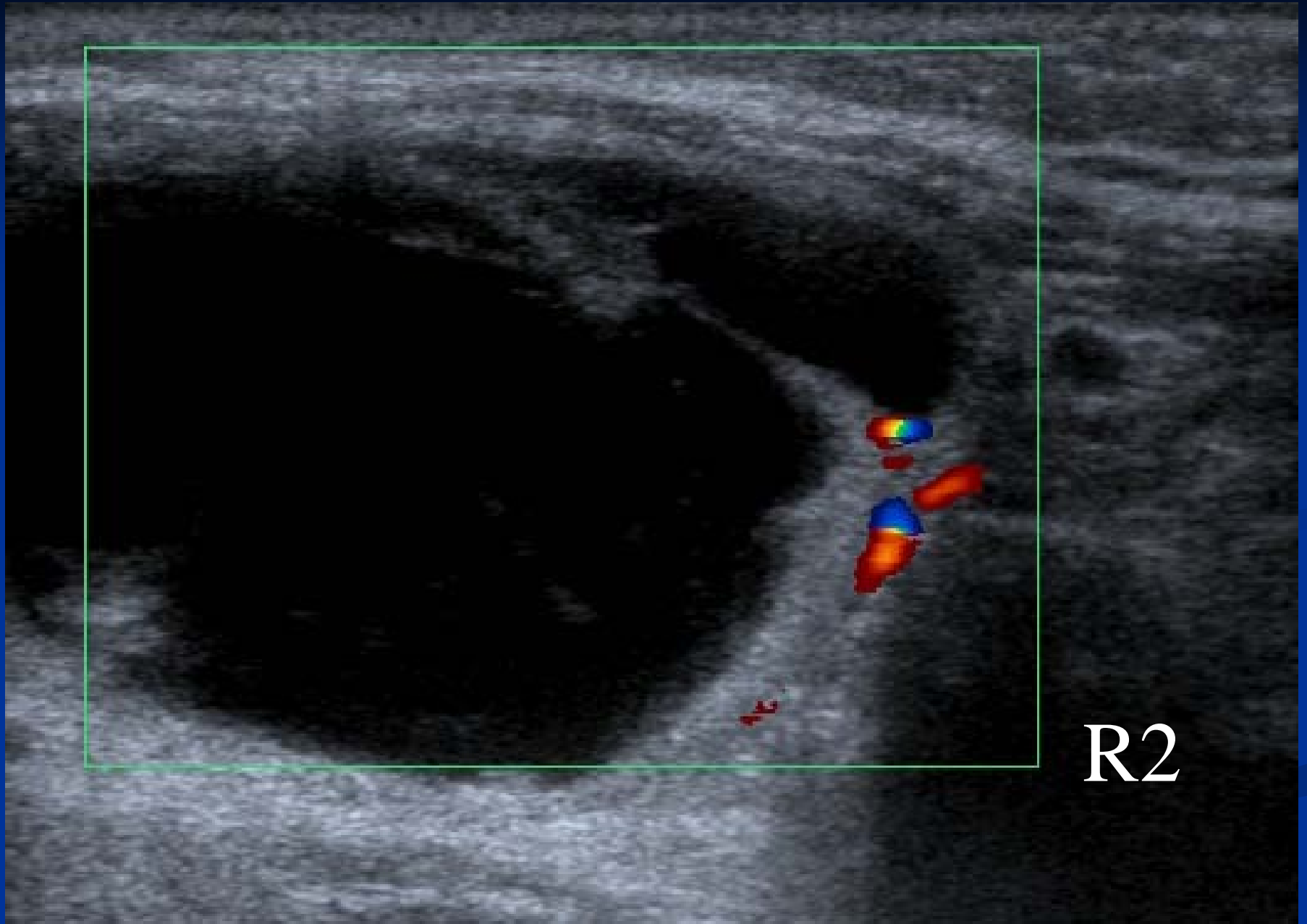
12L5  
T9.0  
CF 5.3  
5 fps

2DG  
88  
DR  
70  
CG  
40  
PRF  
10.9k  
Filter  
5

# Case 5.







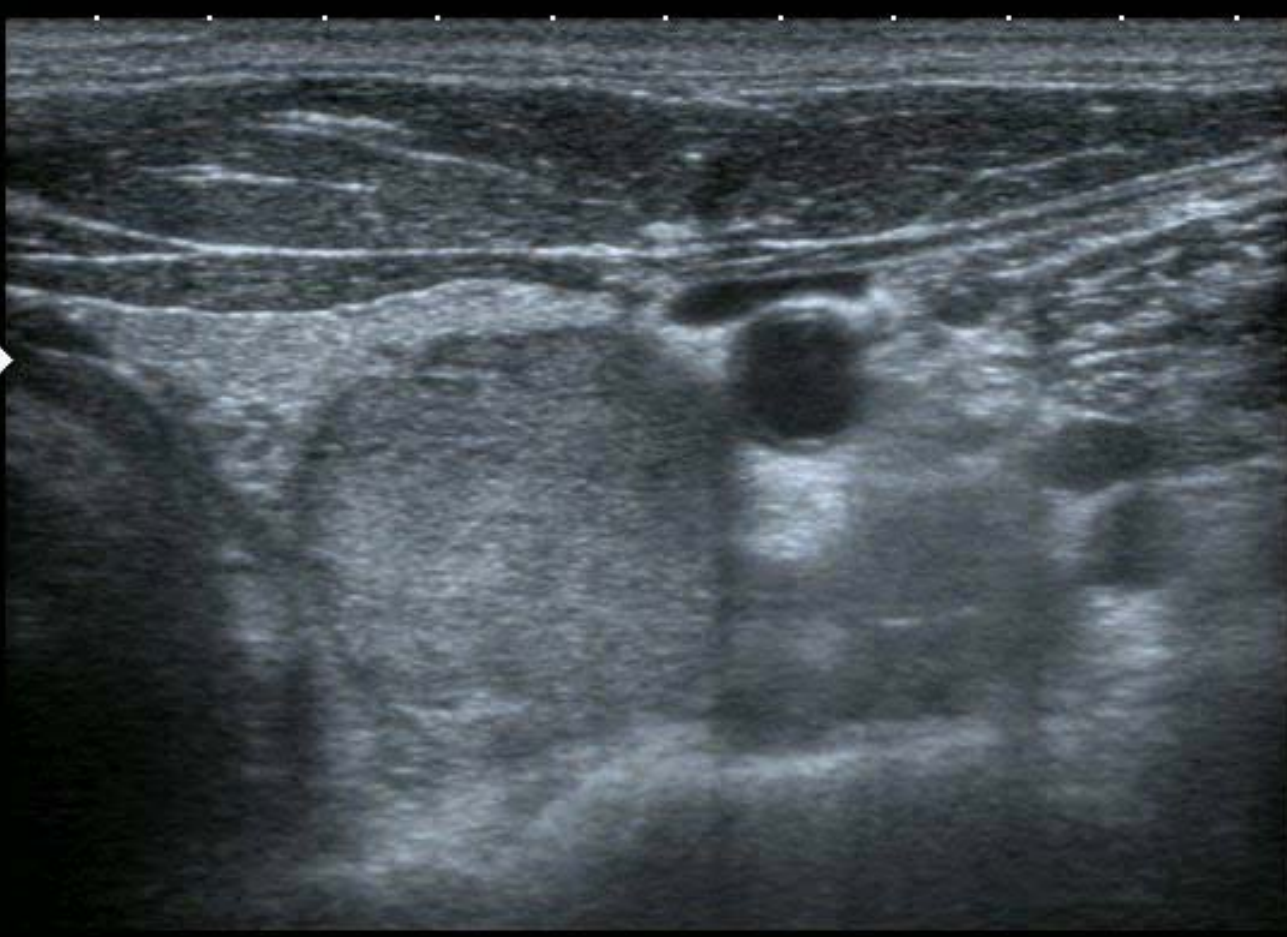
R2

# Case 6.

0 ◆  
1 ◆  
2 ◆  
3 ◆  
4 ◆

12L5  
diffT8.0

36 fps

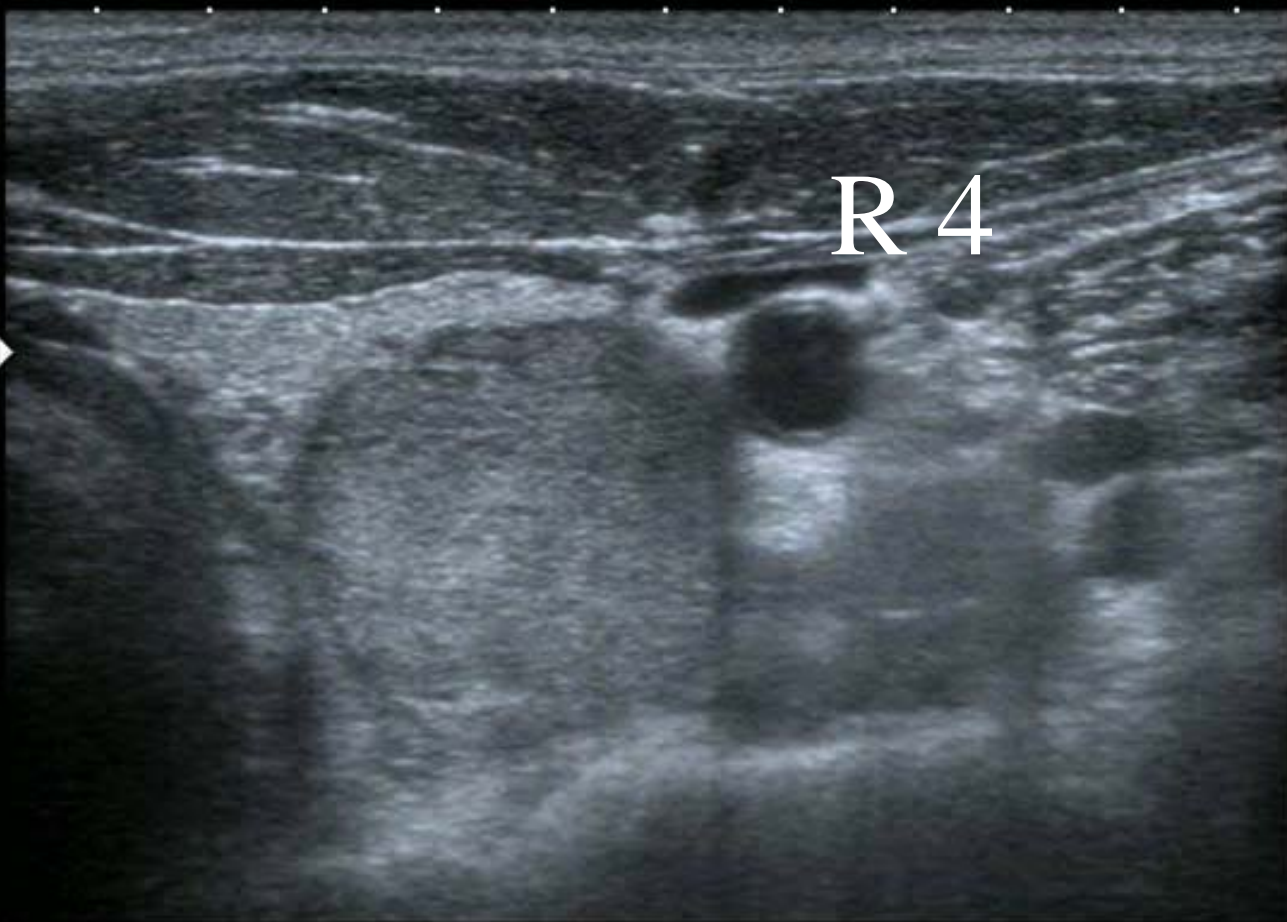


T

MI: 1.6  
2DG  
80  
DR  
65



0  
1  
2  
3  
4



T

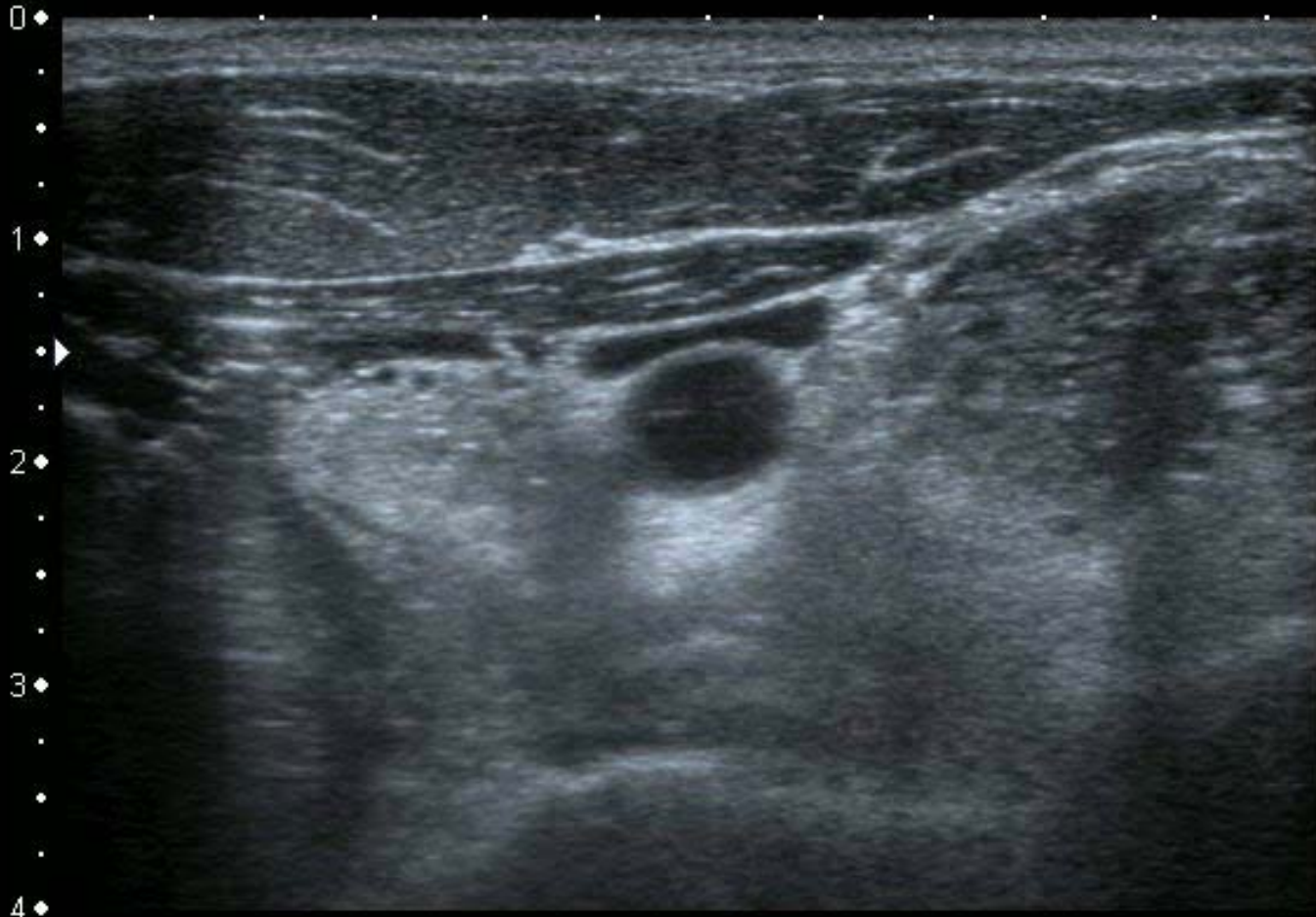
R 4

MI: 1.6  
2DG  
80  
DR  
65

12L5  
diffT8.0

36 fps

A 0 IP4



T

MI: 1.6  
2DG  
80  
DR  
65

12L5  
diffT8.0

36 fps

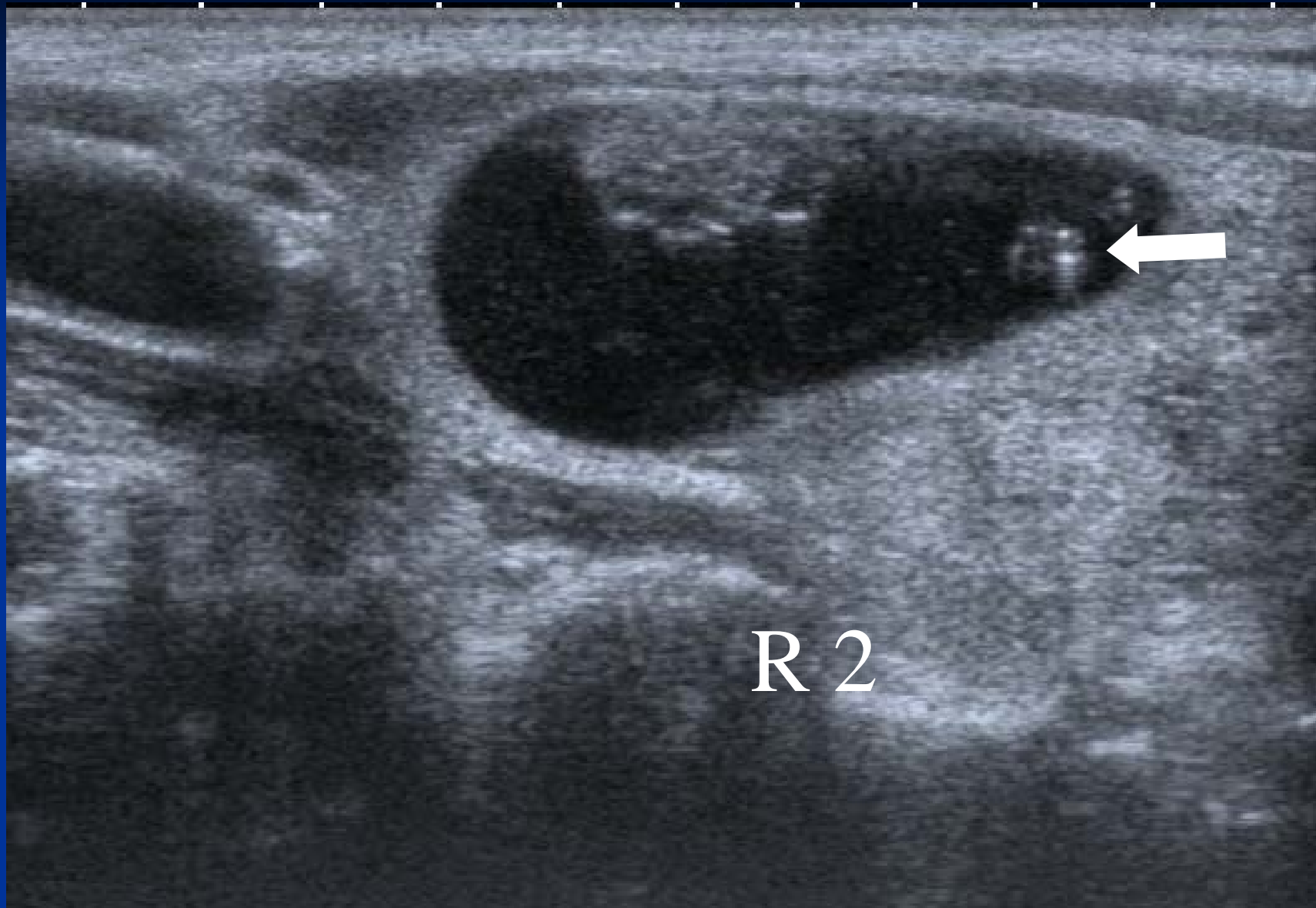
# Case 7.



R1



# Case 8.



R 2

# Case 9.



- 0 ◆
- 1 ◆▶
- 2 ◆
- 3 ◆



T

14L7  
diffT13.0  
25 fps

MI: 1.4  
2DG  
80  
DR  
65

IP4

HDD: 63% Free





- 0 ◆
- 1 ◆▶
- 2 ◆
- 3 ◆



T

14L7  
diffT13.0

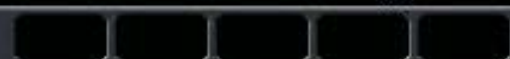
25 fps

MI: 1.4

2DG  
80

DR  
65

IP4





# Ultrasound – predictive value .

- Risk of Malignancy in Nonpalpable Thyroid nodules: Predictive value of Ultrasound and Colour Doppler features.
- Editorial: Nonpalpable Thyroid Nodules – managing an Epidemic
- J.Clin Endoc.&Metab.2002.87(5)1938-1940

# Incidental nodules-predictors of cancer?

- Papini et al: 494 consecutive patients
- Needled nodules between 8-15mm
- Diagnostic Cytology – 402 patients
- Surgical excision : all patients with suspicious & malignant cytology
- Correlation Ultrasound findings with Histology



# Incidental nodules-predictors of cancer?

- 31 (7.7%) cases of malignancy
- Incidence of occult micro-carcinoma :10-30%.
- Papillary(87%),Follicular(6.5%),Medullary (6.5%)
- 347(86.3%) cases of benign disease

# Incidental nodules-predictors of cancer?

- Cancer : risk factors : irregular or blurred margins, intra-nodular vascular pattern and micro – calcification.
- Majority (87%) of cancers can be identified by FNA of solid, hypo-echoic lesions in conjunction with one other risk factor.

# Thyroid Nodules – managing an epidemic.

- Thyroid nodules are the norm.
- Thyroid cancer is rare.
- Specific signs for Thyroid carcinoma.
- Use the signs to classify nodules Radiologically.
- Manage the patient.

