

Thyroid Imaging Reporting and Data System (TI-RADS)

Dr.Hayder Jasim Taher

PhD of Medical Imaging



Outline of my presentation

- ✓ TI-RADS?
  - ✓ Composition
  - ✓ Echogenicity
  - ✓ Shape
  - ✓ Margin
  - ✓ punctate echogenic foci.

Thyroid Imaging Reporting and Data System (TI-RADS)



The Thyroid Imaging Reporting and Data System (TI-RADS) of the American College of Radiology (ACR) was designed in 2017 with the intent to decrease biopsies of benign nodules and improve overall diagnostic accuracy.

The five ultrasound features of thyroid nodules used in TI RADS are as follows

- Composition
- Echogenicity
- Shape
- Margin
- punctate echogenic foci

Each item is given point

Thyroid Imaging Reporting and Data System (TI-RADS)



The points are added from all categories to determine the TI-RADS level, each with a recommendation. Nodules smaller than 5 mm do not need any follow up, even if they are TI-RADS 5.

This is because it is very unlikely that nodules smaller than 5 mm will become a clinically significant malignancy.

The cutoff point of 2.5 cm for fine needle as aspiration (FNA) in mildly suspicious TR3 lesions is based on studies showing that thyroid carcinomas don't have a decreased survival until they reach this threshold value.

The ACR TIRADS category has been shown to have good correlation with the malignancy risk in large studies .

The risk of malignancy is:



TR1: 0.3%

TR2: 1.5%

TR3: 4.8%

TR4: 9.1%

TR5: 35%

Composition

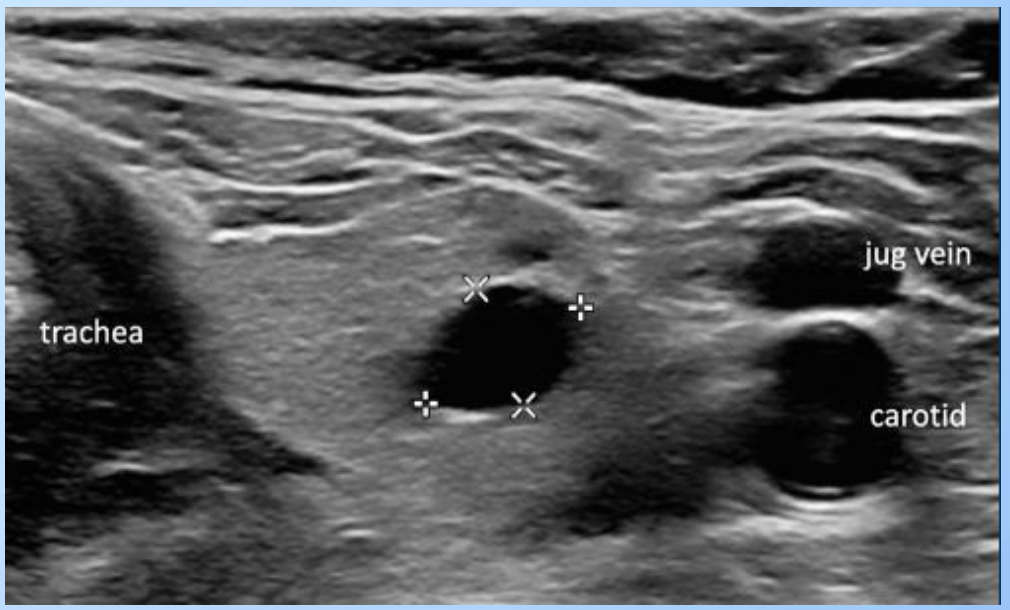


Cystic lesions or lesions that are almost completely cystic are benign and no further points will be added (TI-RADS 1).

This is also true for spongiform lesions which are always benign and no further characterization using ultrasound features is needed.

COMPOSITION (choose 1)	
Cystic	0
Spongiform	0
Mixed cystic / solid	1
Solid	2

TR1 = benign
no further characterization

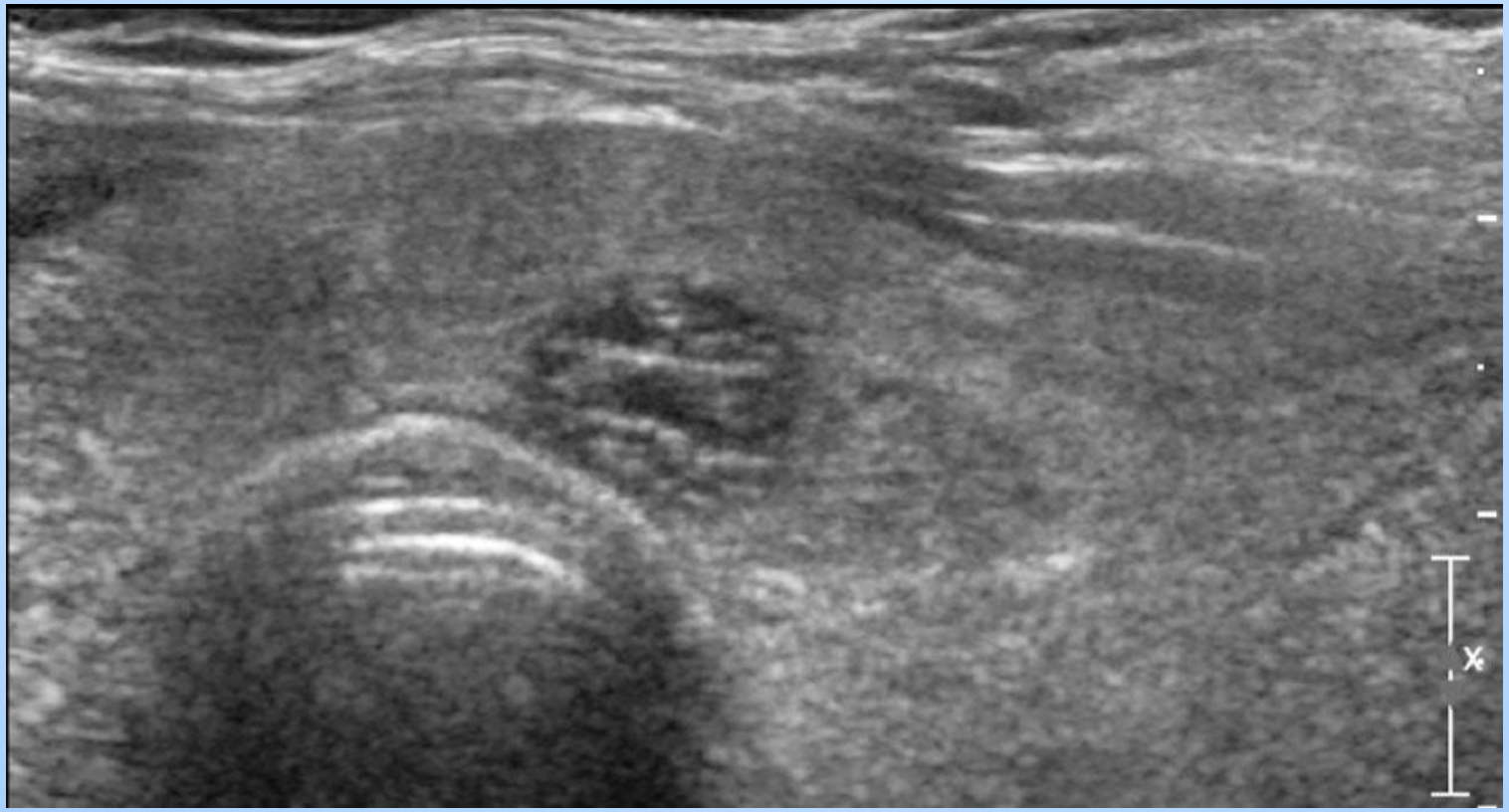


Here a typical cyst. No further evaluation is needed.

Composition



Spongiform nodules have a sponge like appearance, with at least 50% cystic composition of tiny cystic parts.
No further characterization is needed.



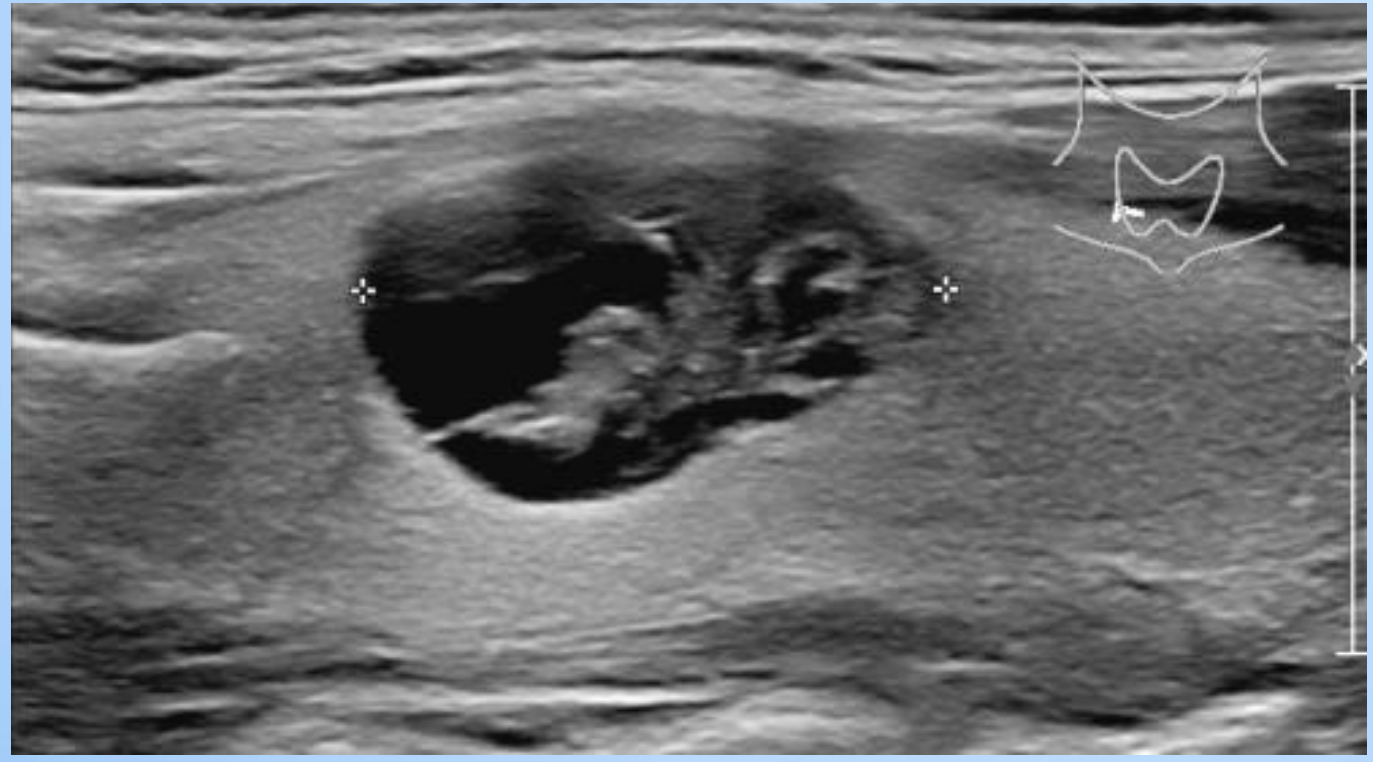
Spongiform nodules

Composition



In **mixed cystic/solid lesions** the amount of cystic and solid parts is not important.

This lesion gets 1 point for the mixed cystic/solid composition.

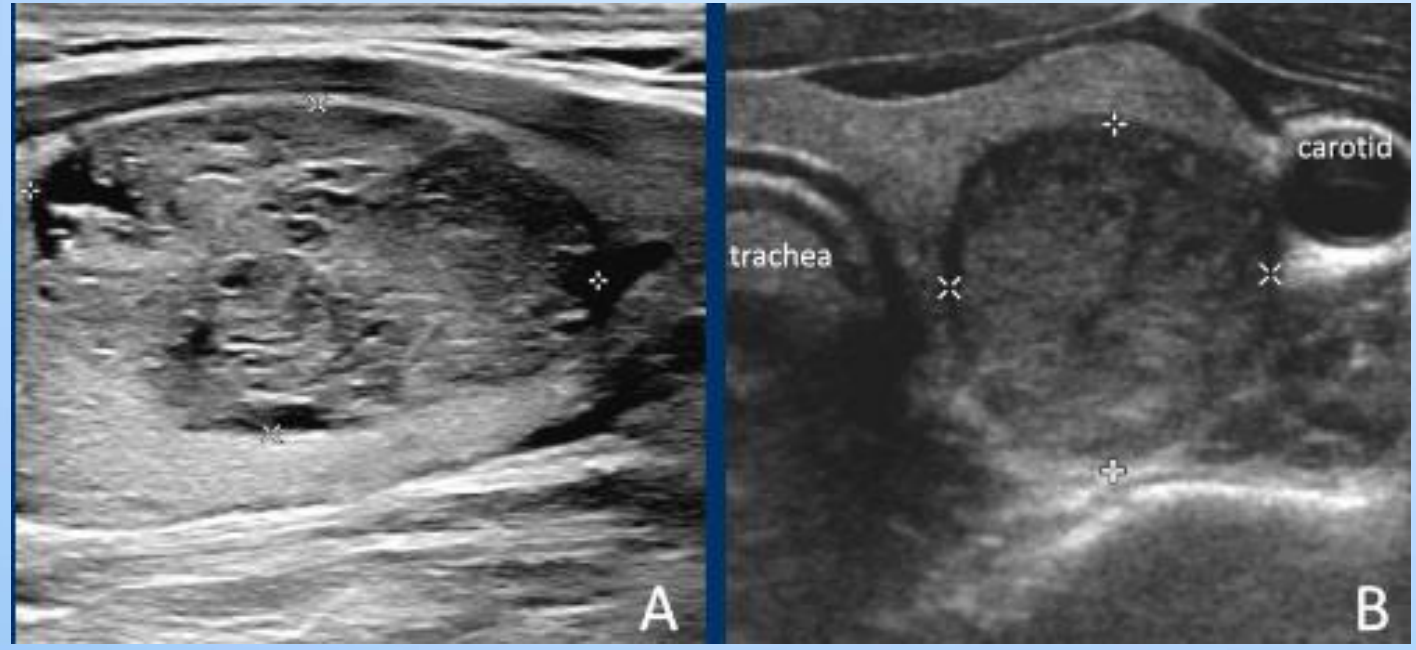


Mixed cystic/solid lesions

Composition



Solid lesions: The lesion in A is almost completely solid. While there are small cystic parts, it is not considered a spongiform nodule, because the small cystic parts are far less than 50% of the total nodule. The lesion in B is completely solid. In solid nodules at least 95% of the nodule should be solid. This percentage should be an estimation, it is not needed to calculate this.



Solid lesions

Echogenicity



An anechoic lesion should be completely black, which means that it is cystic. No further characterization is needed.

Hyperechoic and isoechoic lesions both get 1 point, so for the score it does not matter. The echogenicity is compared with normal thyroid parenchyma

ECHOGENICITY

(choose 1)

Anechoic	0
Hyper- or Isoechoic	1
Hypoechoic	2
Very Hypoechoic	3

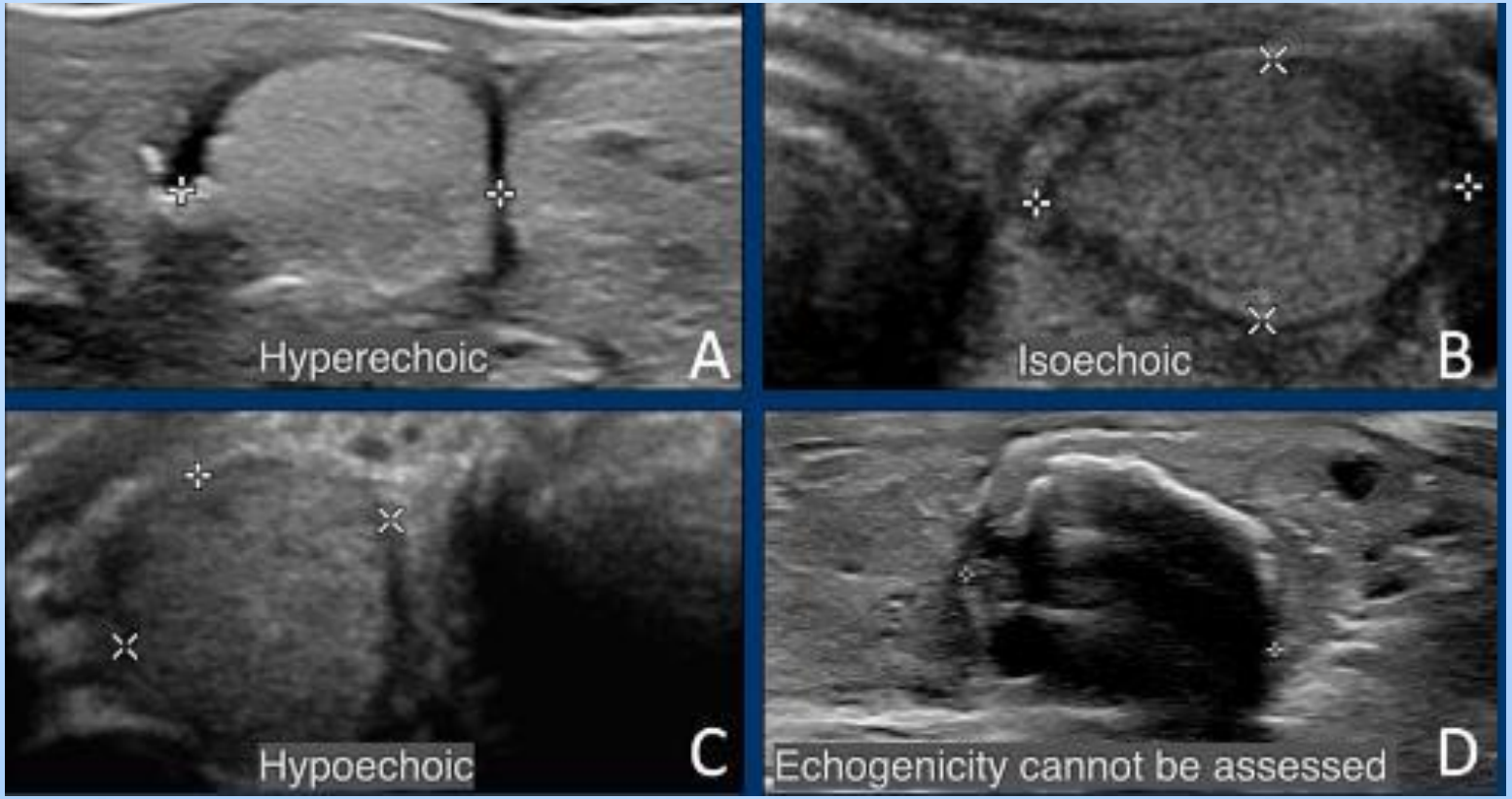
= cystic
no further characterization

Echogenicity



Hypoechoic means that a lesion is more hypoechoic than normal thyroid parenchyma.

If the echogenicity cannot be assed, for example because of calcifications, 1 point is given for the echogenicity.

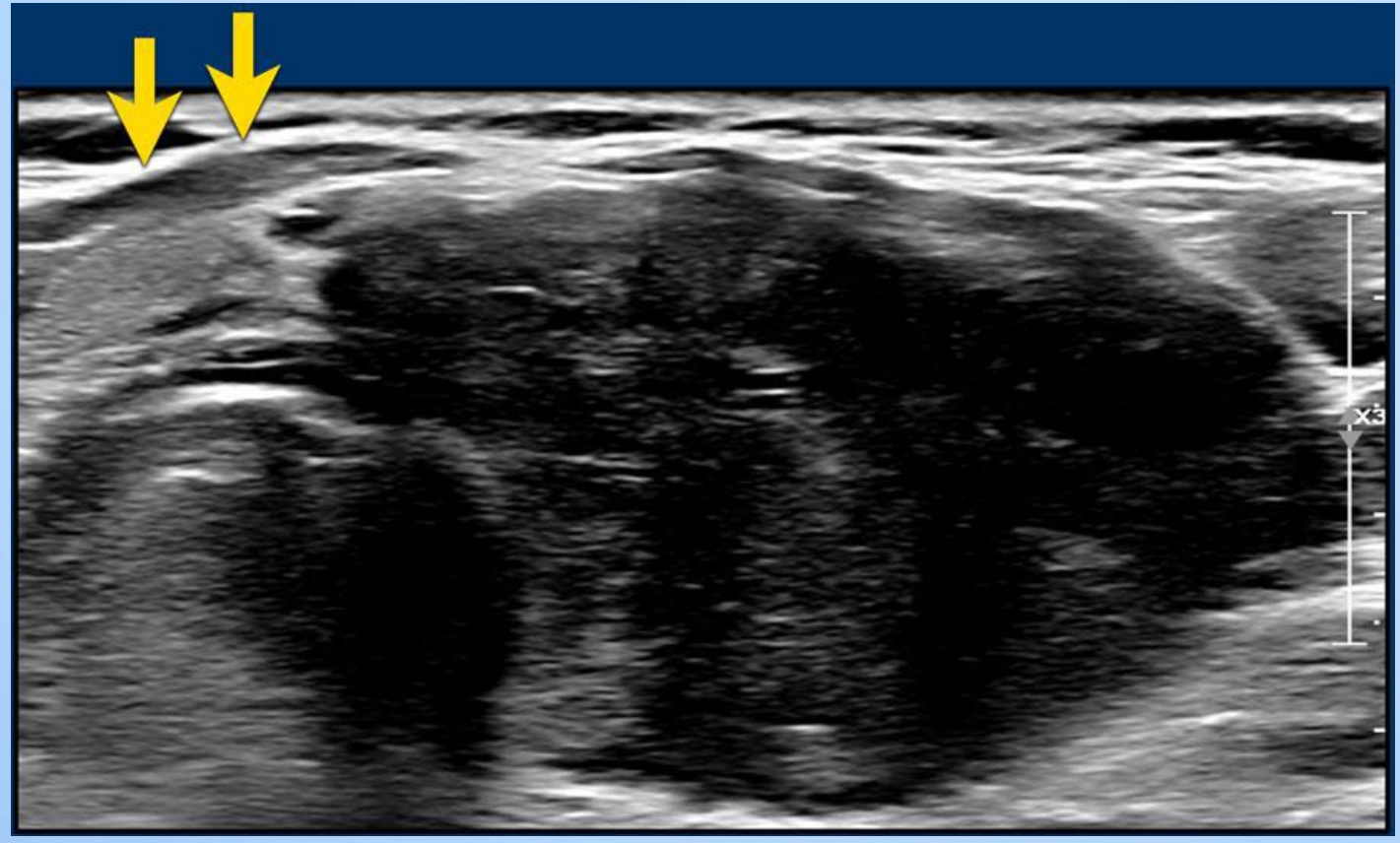


Echogenicity



A very hypoechoic lesion is more hypoechoic than normal muscle.

Notice that the tumor is more hypoechoic in comparison to the strap muscles (arrows)



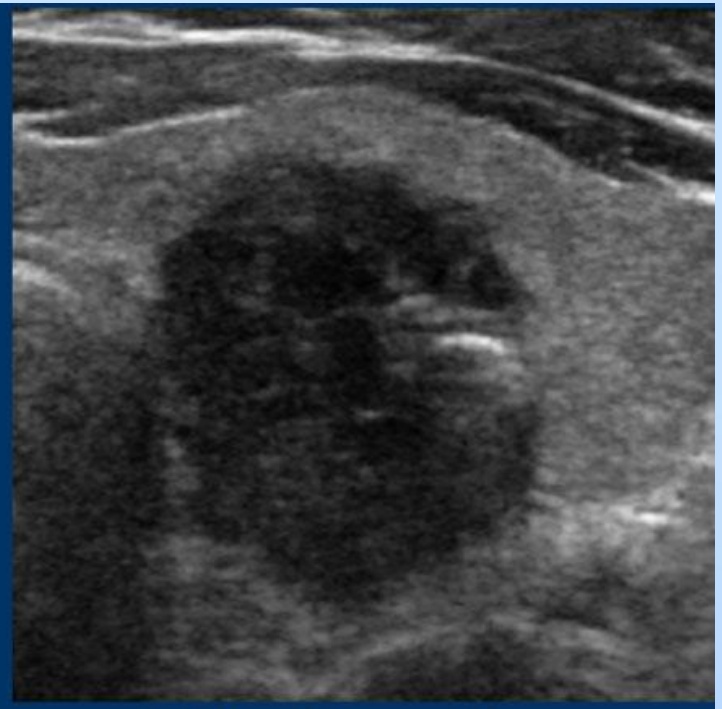
Very hypoechoic , i.e. 3 points in TI-RADS.

Shape

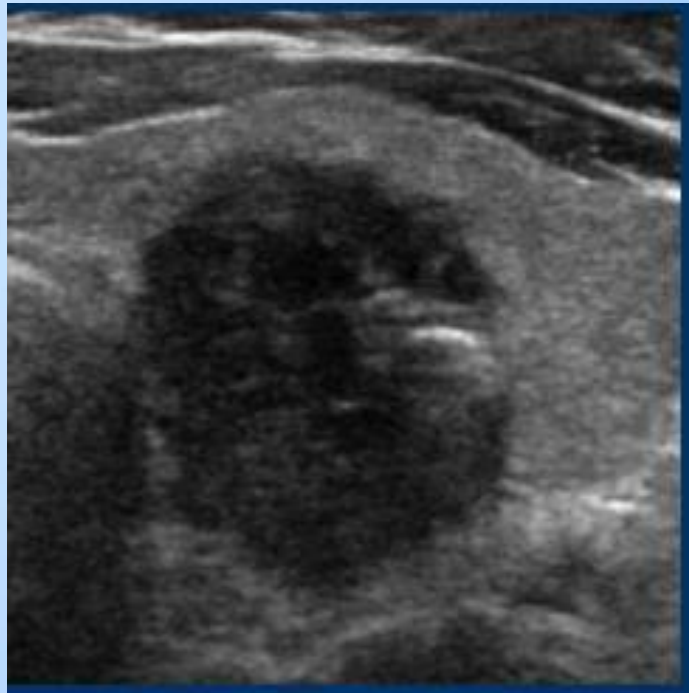


The shape should be assessed in the axial plane. A taller than wide shape is a strong predictor of malignancy, and therefore gets 3 points.

SHAPE (choose 1)	
Wider-than-tall	0
Taller-than-wide	3



Taller than wide



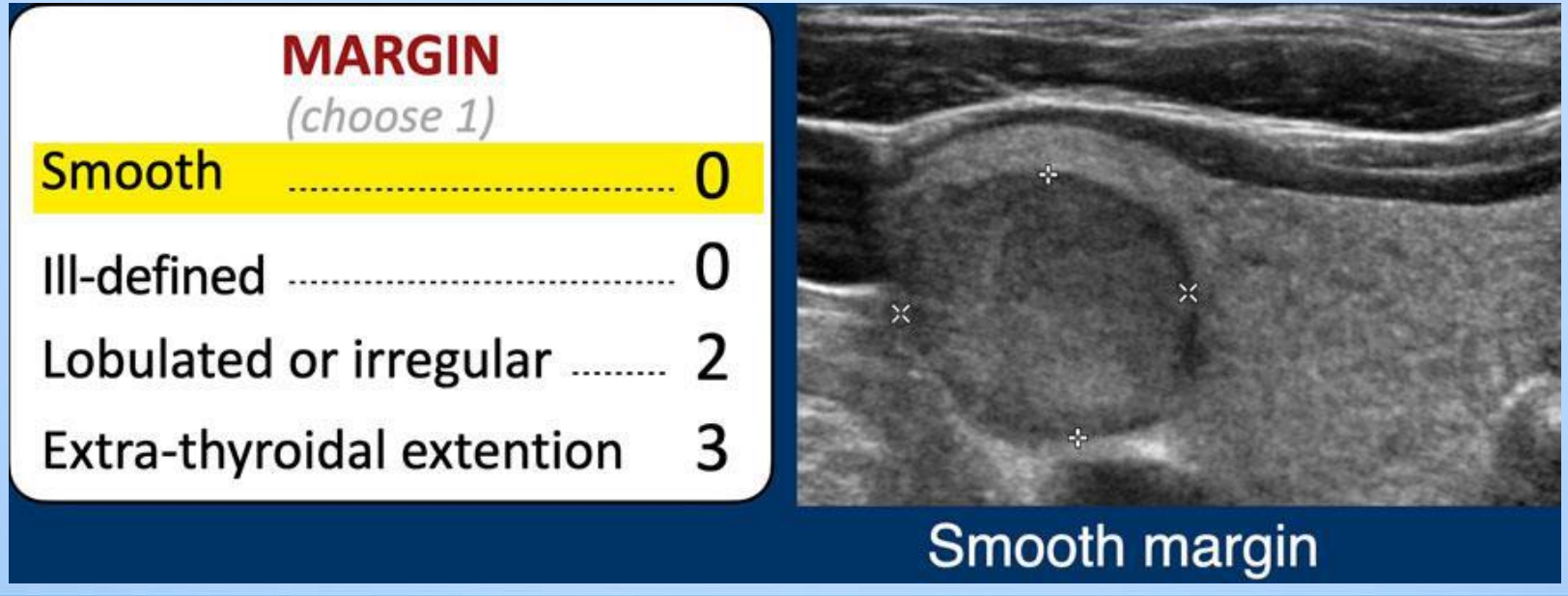
Taller than wide

Margin



The margin is often best assessed on the anterior side.

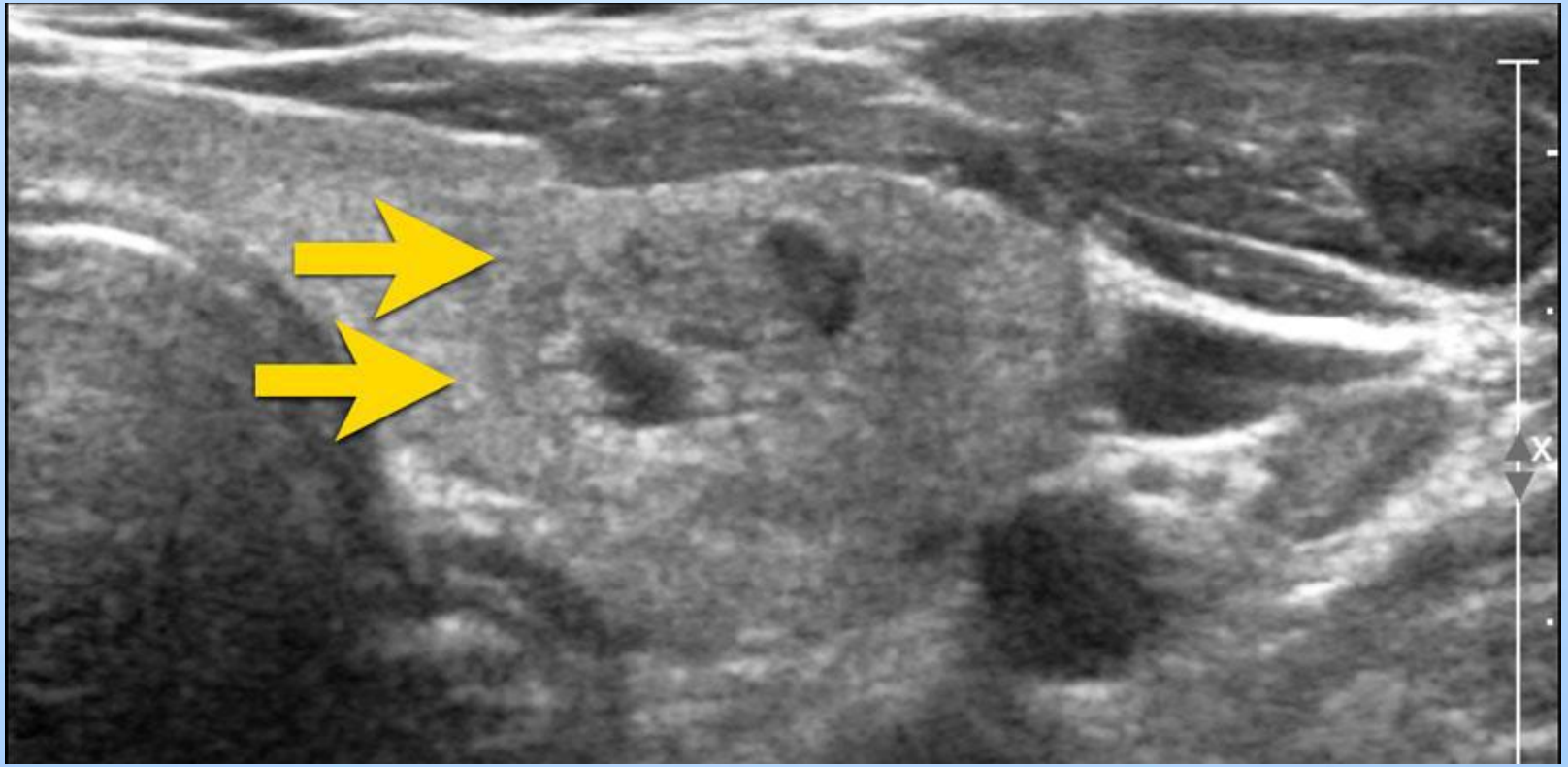
- Smooth: the margin is completely smooth
- Ill-defined: the margins of the nodule cannot be clearly defined from the thyroid parenchyma. This is a benign feature and should be distinguished from the irregular margin.
- Lobulated or irregular: margins are lobulated, spiculated, irregular or angulated.
- Extra-thyroidal extension: difficult to analyze on ultrasound, there should be clear invasion of nearby structures. Bulging of the nodule in nearby structures is not enough.



Margin



Ill defined nodule.
Notice how only some small parts of the border of the nodule can be defined (arrow).
Most of its margin is indistinct from the thyroid parenchyma.
(0 points in TI- RADS)

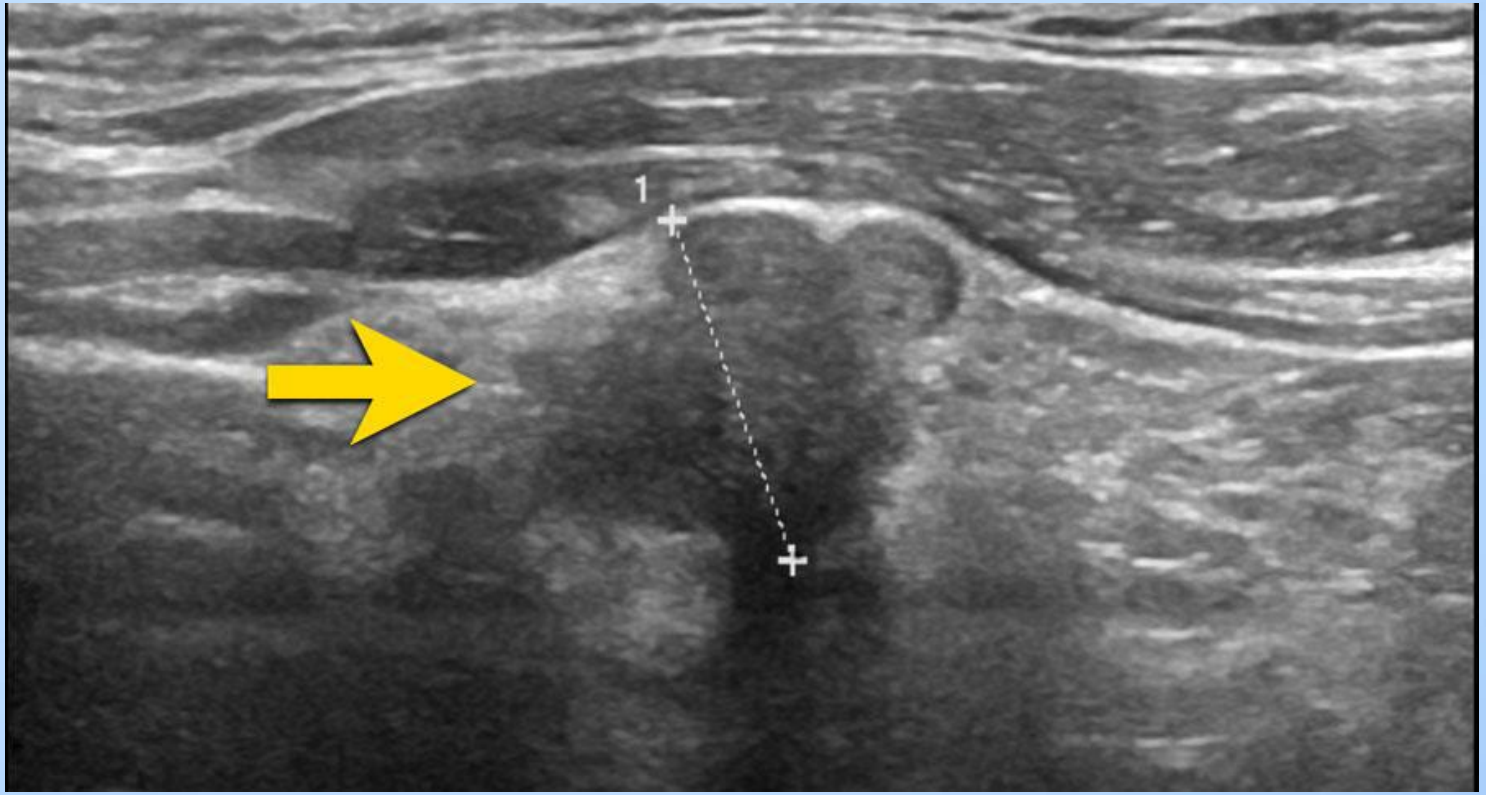


Margin



A nodule with irregular angulated margins.

(2 points in TI-RADS)

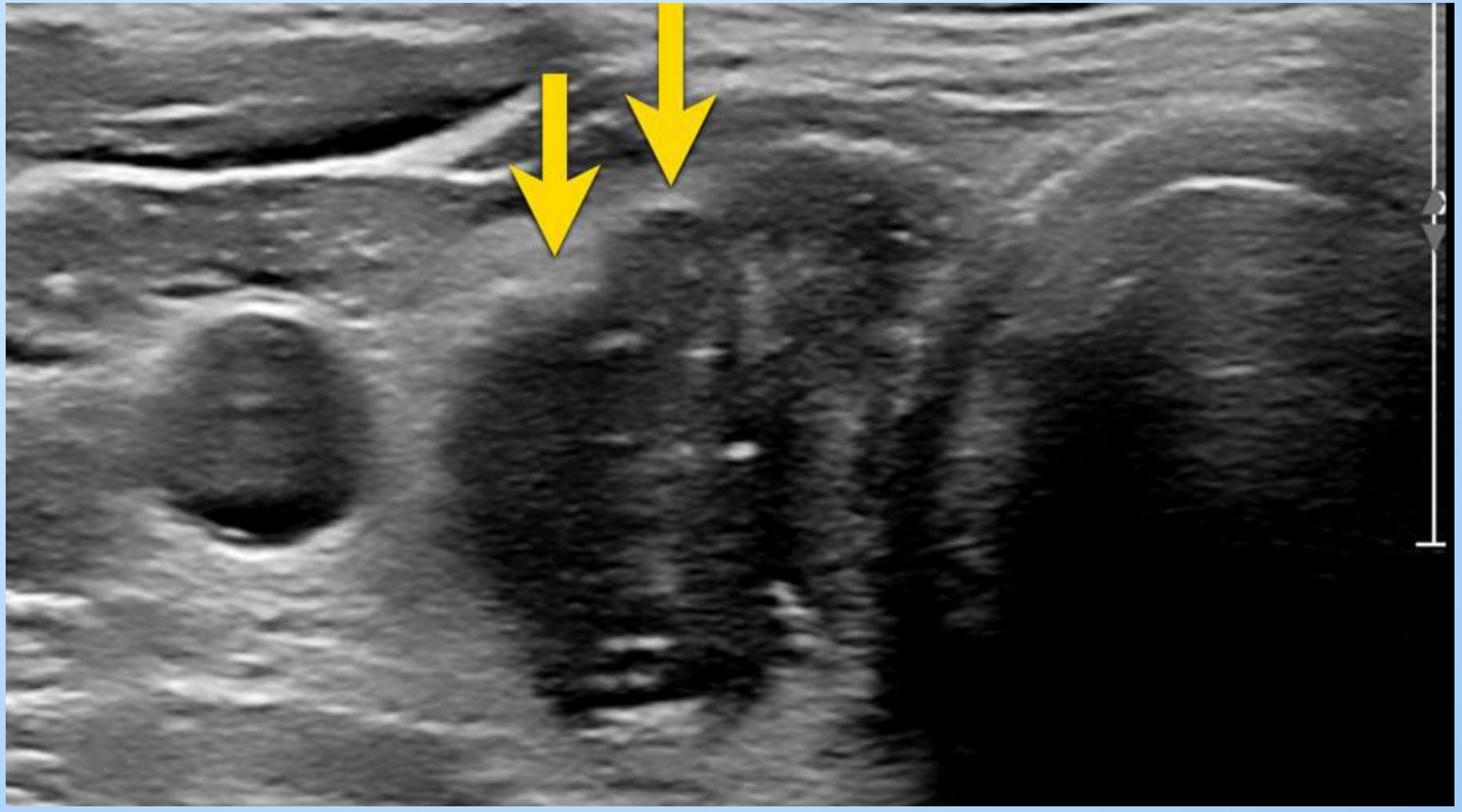


Margin



The image shows an irregular lobulated margin of the anterior surface.

(2 points in TI- RADS)



Echogenic foci



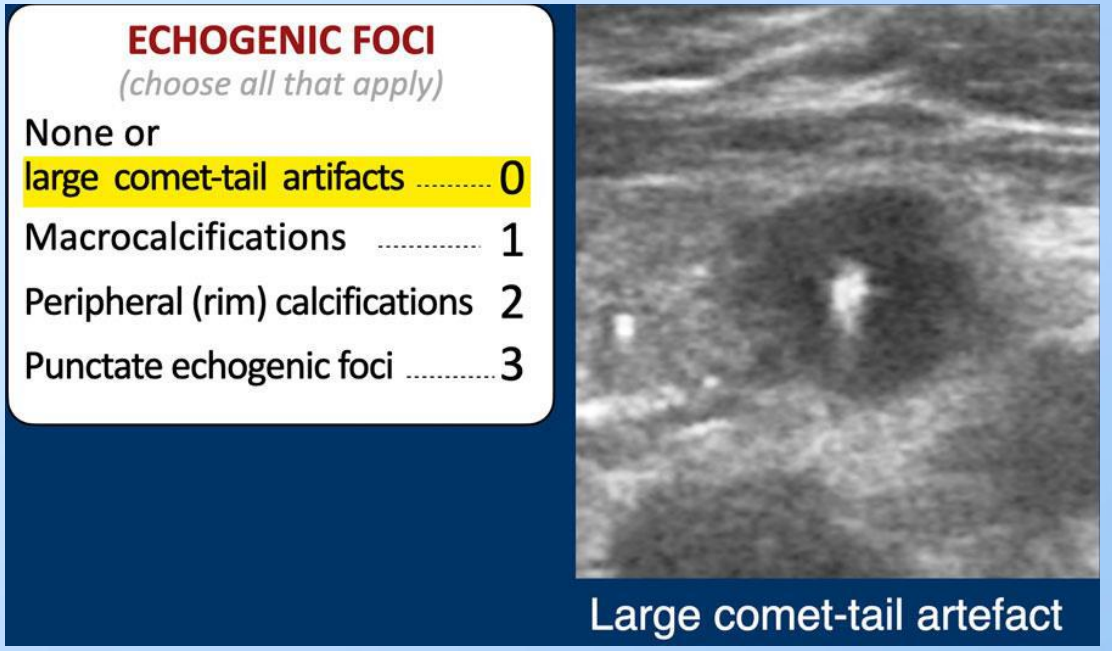
Comet tail artefact

Echogenic foci is the only category where multiple options are possible and you have to choose all that apply. Points will be added to the total score.

This means that when both punctate echogenic foci and rim calcifications are present, the TI-RADS points are 3 + 2 = 5 points

0 points is given for:

- No echogenic foci.
- Large comet tail artefacts > 1 mm (figure).

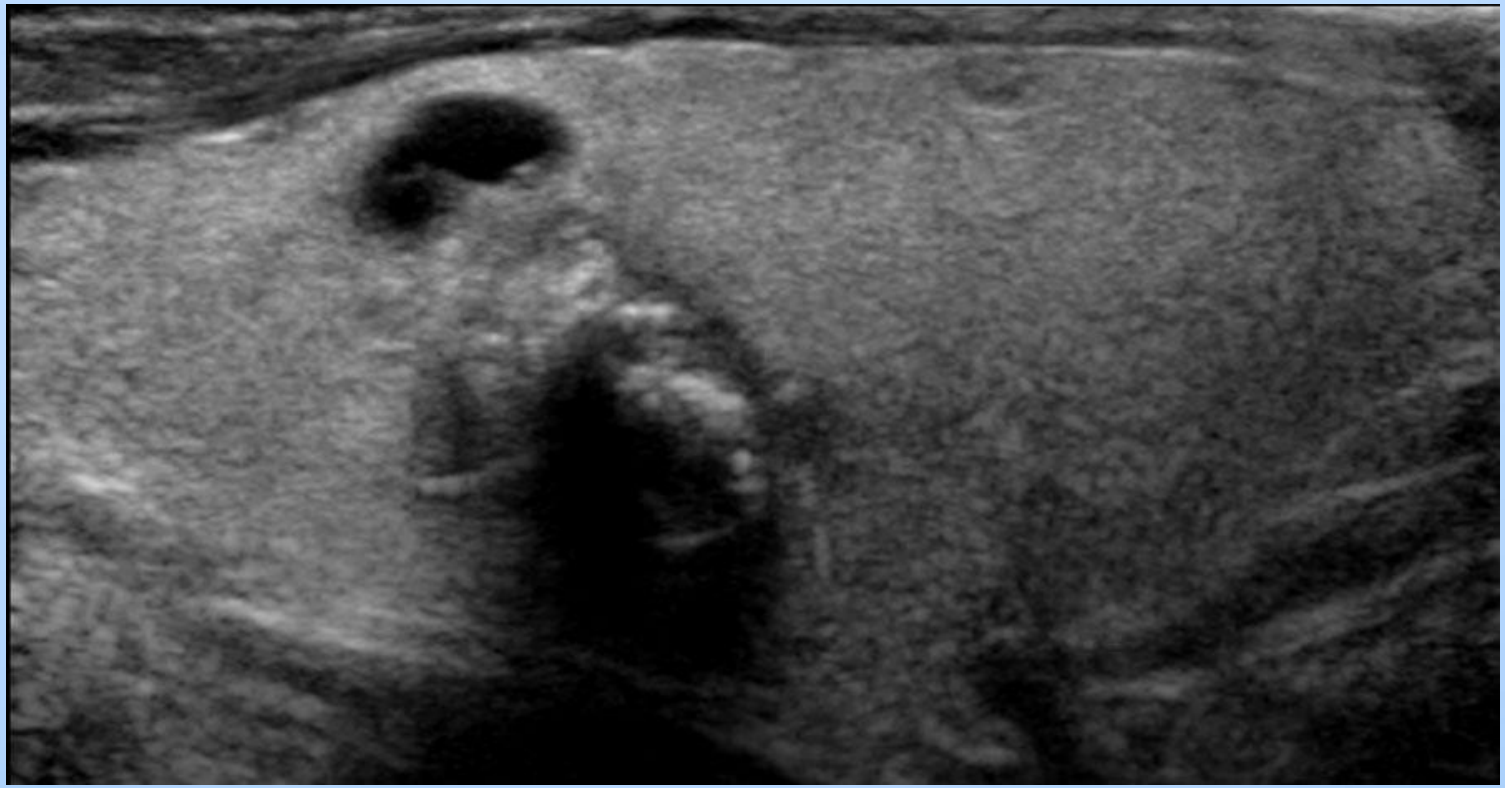


Macrocalcification



This nodule has large macrocalcifications with acoustic shadowing.

TI-RADS: 1 point.

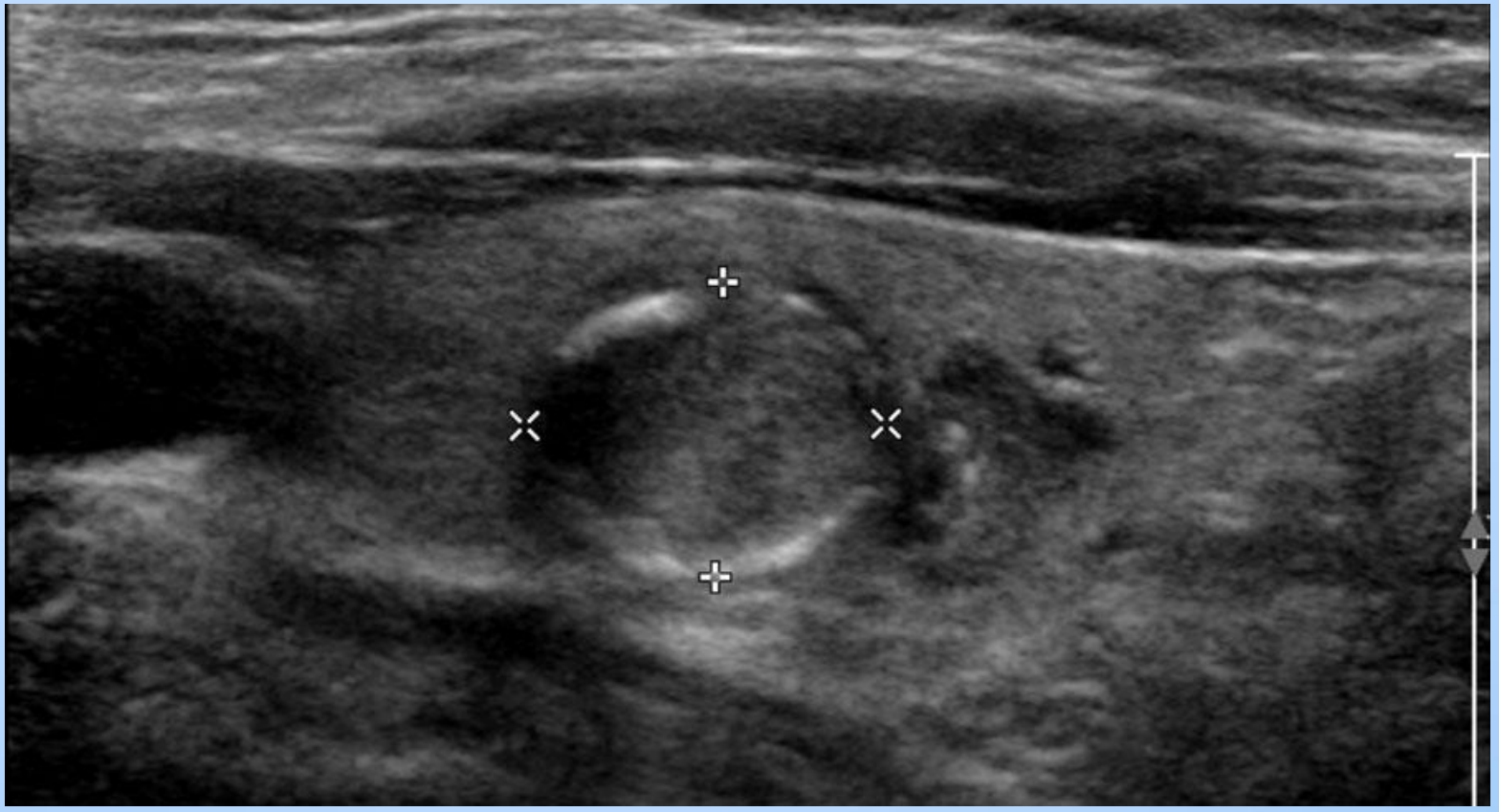


Rim calcification



Peripheral rim calcifications can be complete or incomplete.

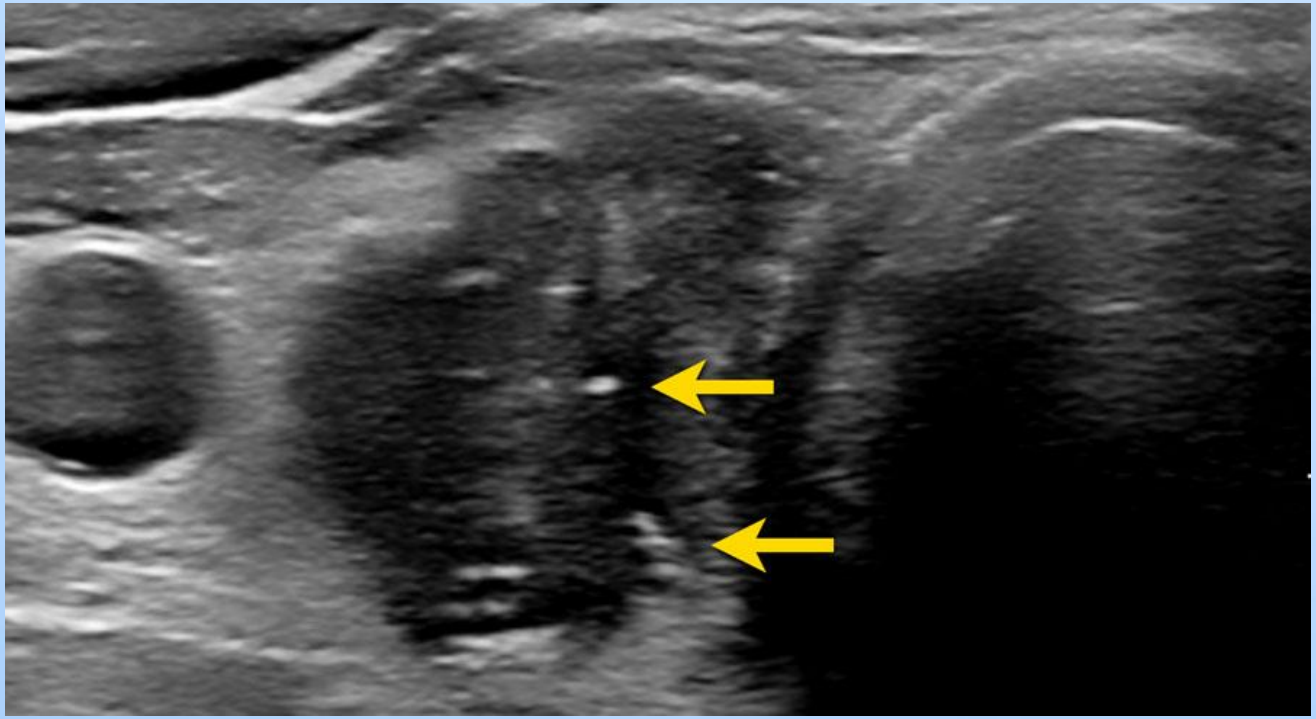
TI-RADS: 2 points



Microcalcifications



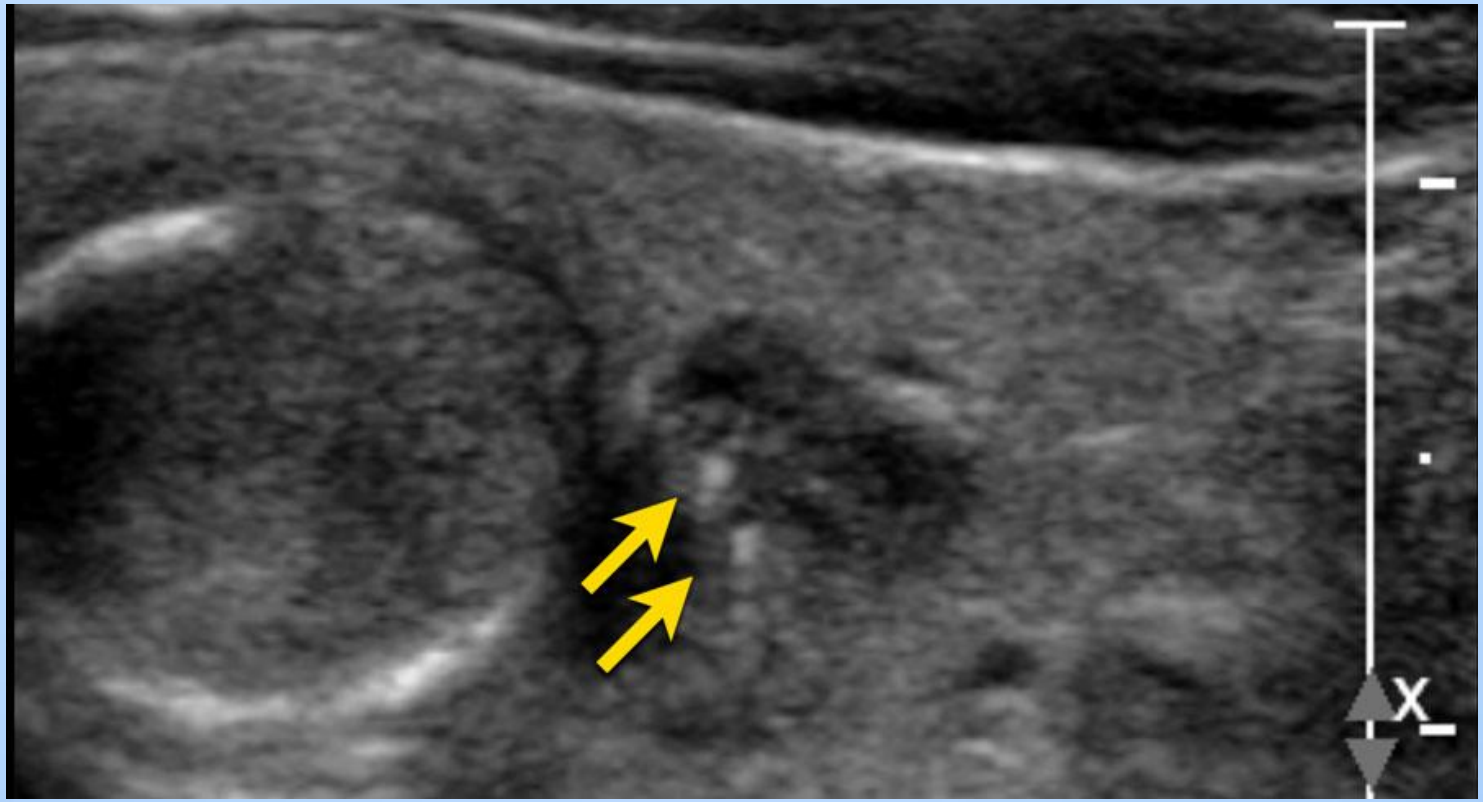
Punctate echogenic foci are also knows as microcalcifications. They are a strong predictor of malignancy and therefore get 3 points.
The ACR lexicon further defined this category, because in the normal thyroid there also may be echogenic foci visible.
Punctate echogenic should be called in the situation where they are obvious and only visible within the nodule.





Small comet tail artifacts with a length less than 1mm are also included in this category.

TI-RADS: 3 points



TI-RADS – Thyroid Imaging Reporting and Data System



COMPOSITION (choose 1)		ECHOGENICITY (choose 1)		SHAPE (choose 1)		MARGIN (choose 1)		ECHOGENIC FOCI (choose all that apply)	
Cystic	0	Anechoic	0	Wider than tall	0	Smooth	0	None or large comet-tail artifacts	0
Spongiform	0	Hyperechoic or Isoechoic	1	Taller-than-wide	3	Ill-defined	0	Macrocalcifications	1
Mixed cystic and solid	1	Hypoechoic	2			Lobulated or irregular	2	Peripheral (rim) calcifications	2
Solid	2	Very Hypoechoic	3			Extra-thyroidal extention	3	Punctate echogenic foci	3

Add points for TI-RADS level

0 points	2 points	3points	4 to 6 points	7 points or more
TR1 Benign No FNA	**TR2** Not suspicious No FNA	**TR3** Mildly suspicious FNA if ≥ 2.5 cm Follow if ≥ 1.5 cm	**TR4** Moderately suspicious FNA if ≥ 1.5 cm Follow if ≥ 1 cm	**TR5** Highly suspicious FNA if ≥ 1 cm Follow if ≥ 0.5 cm


Thank you