A classificação TI-RADS é realmente útil?

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TI-RADS

- Histórico
  - Necessidade de padronização de conduta
  - Padronização de nomenclatura dos achados
  - Classificação de acordo com a probabilidade de câncer
  - BI-RADS
  - Início em 2009

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  - Classificação de acordo com a probabilidade de câncer
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  - Início em 2009

J Clin Endocrinol Metab. 2009 May;94(5):1748-51. doi: 10.1210/jc.2008-1724. Epub 2009 Mar 10.

An ultrasonogram reporting system for thyroid nodules stratifying cancer risk for clinical management.

Horvath E[1], Majlis S, Rossi R, Franco C, Niedmann JP, Castro A, Dominguez M.

Author information

[1]Thyroid Board, Clinica Alemana de Santiago, Av. Vitacura 5951 Santiago, Chile.

TI-RADS – Critérios iniciais

TABLE 1. US characteristics of thyroid nodules, 10 US patterns with their malignancy risk, and TIRADS category

Description of US pattern	US patterns	Malignancy	TIRADS
Anechoic with hyperechoic spots, nonvascularized lesion.	Colloid type 1		
Nonencapsulated, mixed, nonexpansile, with hyperechoic spots, vascularized lesion, "grid" aspect (spongiform nodule).	Colloid type 2	0%	TIRADS 2: benign findings
Nonencapsulated, mixed with solid portion, isoechogenic, expansile, vascularized nodule with hyperechoic spots.	Colloid type 3		
Hyper, iso, or hypoechoic, partially encapsulated nodule with peripheral vascularization, in Hashimoto's thyroiditis.	Hashimoto pseudo-nodule	<5%	TIRADS 3: probably benign
Solid or mixed hyper, iso, or hypoechoic nodule, with a thin capsule.	Simple neoplastic pattern	5–10%	TIRADS 4A: undetermined
Hypoechoic lesion with ill-defined borders, without calcifications.	de Quervain pattern		
Hyper, iso, or hypoechoic, hypervascularized, encapsulated nodule with a thick capsule, containing calcifications (coarse or microcalcifications).	Suspicious neoplastic pattern		
Hypoechoic, nonencapsulated nodule, with irregular shape and margins, penetrating. vessels, with or without calcifications	Malignant pattern A	10–80%	TIRADS 4B: suspicious
Iso or hypoechoic, nonencapsulated nodule with multiple peripheral microcalcifications and hypervascularization.	Malignant pattern B	>80%	TIRADS 5: consistent with malignancy
Nonencapsulated, isoechoic mixed hypervascularized nodule with or without calcifications, without hyperechoic spots.	Malignant pattern C Cancer, confirmed by previous biopsy	100%	TIRADS 6: malignant

Horvath E. et al. J Clin Endocrinol Metab. 2009 May;94(5):1748-51

Reprodutibilidade do TI-RADS inicial

Interobserver Agreement of Thyroid Imaging Reporting and Data System (TIRADS) and Strain Elastography for the Assessment of Thyroid Nodules

Mireen Friedrich-Rust[1]*, Gesine Meyer[1], Nina Dauth[1], Christian Berner[1], Dimitra Bogdanou[1], Eva Herrmann[2], Stefan Zeuzem[1], Joerg Bojunga[1]

1 Department of Internal Medicine 1, J.W.Goethe-University Hospital, Frankfurt, Germany, **2** Institute of Biostatistics and Mathematical Modelling, Faculty of Medicine, J.W. Goethe-University, Frankfurt, Germany

Abstract

Background: Thyroid Imaging Reporting and Data System (TIRADS) was developed to improve patient management and cost-effectiveness by avoiding unnecessary fine needle aspiration biopsy (FNAB) in patients with thyroid nodules. However, its clinical use is still very limited. Strain elastography (SE) enables the determination of tissue elasticity and has shown promising results for the differentiation of thyroid nodules.

Methods: The aim of the present study was to evaluate the interobserver agreement (IA) of TIRADS developed by Horvath et al. and SE. Three blinded observers independently scored stored images of TIRADS and SE in 114 thyroid nodules (114 patients). Cytology and/or histology was available for all benign ($n=99$) and histology for all malignant nodules ($n=15$).

Results: The IA between the 3 observers was only fair for TIRADS categories 2–5 (Cohens kappa $=0.27, p=0.000001$) and TIRADS categories 2/3 versus 4/5 ($ck=0.25, p=0.0020$). The IA was substantial for SE scores 1–4 ($ck=0.66, p<0.000001$) and very good for SE scores 1/2 versus 3/4 ($ck=0.81, p<0.000001$). 92–100% of patients with TIRADS-2 had benign lesions, while 28–42% with TIRADS-5 had malignant cytology/histology. The negative-predictive-value (NPV) was 92–100% for TIRADS using TIRADS-categories 4&5 and 96–98% for SE using score ES-3&4 for the diagnosis of malignancy, respectively. However, only 11–42% of nodules were in TIRADS-categories 2&3, as compared to 58–60% with ES-1&2.

Conclusions: IA of TIRADS developed by Horvath et al. is only fair. TIRADS and SE have high NPV for excluding malignancy in the diagnostic work-up of thyroid nodules.

Friedrich-Rust M, Meyer G, Dauth N, et al. Hendrikse J, ed. PLoS ONE. 2013;8(10):e77927.

Modelo matemático para TI-RADS

Thyroid. 2009 Nov;19(11):1257-64. doi: 10.1089/thy.2008.0021.

A proposal for a thyroid imaging reporting and data system for ultrasound features of thyroid carcinoma.

Park JY[1], Lee HJ, Jang HW, Kim HK, Yi JH, Lee W, Kim SH.

Author information

[1]Department of Pathology, Kyungpook National University Hospital, Daegu 700-721, Republic of Korea.

Abstract

BACKGROUND: Several thyroid ultrasound (TUS) findings have been associated with an increased risk for thyroid cancer; however, there is no consensus as to the format and style for reporting the results of TUS. The objective of this study was to discover the features indicative of malignancy in thyroid nodules based on TUS, generate an equation using these features that would be predictive of malignancy in thyroid nodules, and stratify the results of this equation into TUS categories reflecting the probability of malignancy.

METHODS: We obtained odds ratios of TUS findings indicative of malignancy and probability of malignancy for each nodule as determined by logistic regression analysis of ultrasound (US) findings in 1694 patients who had US-guided fine-needle aspiration biopsy. We then generated an equation to predict the probability of malignancy based on TUS and developed categories ranging from lowest to highest probability of malignancy. We evaluated the reliability of this equation and the categories using cytology and histopathology information regarding malignancy in the thyroid nodules.

RESULTS: We characterized 12 aspects of thyroid nodules as seen on TUS and developed an equation to predict P(us), the probability of a nodule being malignant based on these US findings. The equation was $P(us) = 1/(1 + e(-z))$, where e is the mathematical constant 2.71828 and z is the logit of malignant thyroid nodule. P(us) was stratified into five categories based on the probability of a nodule being malignant as indicated by the findings (TUS 1, benign; TUS 2, probably benign; TUS 3, indeterminate; TUS 4, probably malignant; TUS 5, malignant). There was a significant correlation between the cytological category and the TUS 1 through TUS 5 categories ($r = 0.491$, $p < 0.001$).

CONCLUSIONS: We propose an equation to predict the probability of malignancy in thyroid nodules based on 12 features of thyroid nodules as noted on TUS. This equation, and the stratification of its results into categories, should be useful in reporting the findings of US for thyroid nodules and in guiding management decisions.

Propostas de melhoria da classificação

Thyroid Imaging Reporting and Data System for US Features of Nodules: A Step in Establishing Better Stratification of Cancer Risk[1]

Radiology

Jin Young Kwak, MD
Kyung Hwa Han, MS
Jung Hyun Yoon, MD
Hee Jung Moon, MD
Eun Ju Son, MD
So Hee Park, MD
Hyun Kyung Jung, MD
Ji Soo Choi, MD
Bo Mi Kim, MD
Eun-Kyung Kim, MD

Purpose: To develop a practical thyroid imaging reporting and data system (TIRADS) with which to categorize thyroid nodules and stratify their malignant risk.

Materials and Methods: The institutional review board approved this retrospective study, and the requirement to obtain informed consent for the review of images and records was waived. From May to December 2008, ultrasonographically (US)-guided fine-needle aspiration biopsy (FNAB) was performed in 3674 focal thyroid nodules in 3414 consecutive patients. The study included the 1658 thyroid nodules (≥1 cm in maximum diameter at US) in 1638 patients (1373 women, 265 men) for which pathologic diagnosis or follow-up findings were available. Univariate and multivariate analyses with generalized estimating equations were performed to in-

Kwak JY et al. Radiology. 2011 Sep;260(3):892-9.

Análise uni e multivariada

Table 3

Association between Thyroid Malignancy and Various US Features

Parameter	No. of Malignant Nodules (n = 275)*	No. of Benign Nodules (n = 1383)*	Univariate Analysis		Multivariate Analysis	
			Odds Ratio†	P Value‡	Odds Ratio†	P Value§
Composition				<.001		
Solid (n = 1060)	255 (24.1)	805 (75.9)	9.155 (5.745, 14.587)	...	1.796 (1.063, 3.031)	.029
Mixed (n = 598)	20 (3.3)	578 (96.7)	1	...	1	...
Echogenicity				<.001		
Hyper/isoechogenicity (n = 900)	43 (4.8)	857 (95.2)	1	...	1	...
Hypoechogenicity (n = 677)	169 (25.0)	508 (75.0)	6.630 (4.635, 9.486)	...	1.955 (1.264, 3.023)	.003
Marked hypoechogenicity (n = 81)	63 (77.8)	18 (22.2)	69.756 (37.216, 130.747)	...	3.828 (1.627, 9.010)	.002
Margins				<.001		
Well circumscribed (n = 1330)	68 (5.1)	1262 (94.9)	1	...	1	...
Microlobulated (n = 221)	115 (52.0)	106 (48.0)	20.135 (14.038, 28.880)	...	4.993 (3.061, 8.146)	<.001
Irregular (n = 107)	92 (86.0)	15 (14.0)	113.828 (60.771, 213.205)	...	15.364 (7.179, 32.883)	<.001
Calcifications				<.001		
Microcalcifications (n = 162)	111 (68.5)	51 (31.5)	25.871 (17.503, 38.240)	...	5.908 (3.395, 10.283)	<.001
Macrocalcifications (n = 246)	67 (27.2)	179 (72.8)	4.449 (3.119, 6.346)	...	1.414 (0.890, 2.247)	.142
No calcifications (n = 1250)	97 (7.8)	1153 (92.2)	1	...	1	...
Shape				<.001		
Wider than tall (n = 1460)	134 (9.2)	1326 (90.8)	1	...	1	...
Taller than wide (n = 198)	141 (71.2)	57 (28.8)	24.478 (17.152, 34.933)	...	3.662 (2.182, 6.147)	<.001

* Numbers in parentheses are percentages.

† Numbers in parentheses are 95% confidence intervals.

‡ Determined with the χ^2 test.

§ Determined with logistic regression analysis.

Kwak JY et al. Radiology. 2011 Sep;260(3):892-9.

Probabilidade de câncer de acordo com o número de variáveis

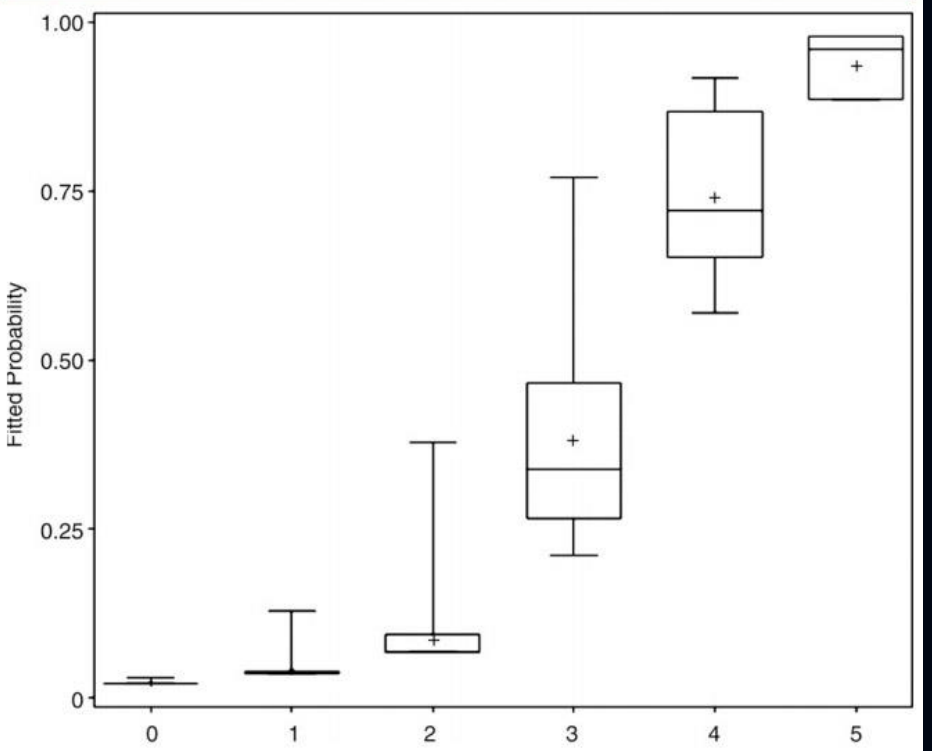

Figure 3: Box plot shows fitted probabilities of malignancy calculated with logistic regression by using US features of the 1658 thyroid nodules. Probabilities are shown according to number of suspicious US features (x-axis). The lower and upper ends of vertical lines are minimum and maximum values of the probability of malignancy. The upper edge of the box is the 75th percentile of the data set; lower hinge represents the 25th percentile. The line in the box represents the median, and points indicated by + are means.

Kwak JY et al. Radiology. 2011 Sep;260(3):892-9.

Table 4

Comparison of Several Classification Systems

Study and Parameter	Category 1	2	3	4	5
Horvath et al (13)					
Definition	Benign	Benign	Probably benign	4a: undetermined; 4b: suspicious	Consistent with malignancy
Proposed risk of malignancy	0	0	<5	4a: 5–10; 4b: 10–80	>80
Risk of malignancy	0	0	14.1	45	89.6
Park et al (12)					
Definition	Highly suggestive of benignity	Probably benign	Indeterminate	Probably malignant	Highly suggestive of malignancy
Probability*	0–7	8–23	24–50	51–90	91–100
Risk of malignancy	1.8	9.6	31.1	76.8	100
BI-RADS (14)					
Definition	Negative	Benign	Probably benign	4a: low suspicion for malignancy; 4b: intermediate suspicion for malignancy; 4c: moderate concern but not classic for malignancy	Highly suggestive of malignancy
Risk of malignancy	0	0	<2	4a: 2–10; 4b: 10–50; 4c: 50–95	>95
Current study					
Definition	Negative	Benign	Probably benign (no suspicious US features)	4a: low suspicion for malignancy (one suspicious US feature); 4b: intermediate suspicion for malignancy (two suspicious US features); 4c: moderate concern but not classic for malignancy (three or four suspicious US features)	Highly suggestive of malignancy (five suspicious US features)
Fitted probability†	0	0	2–2.8	4a: 3.6–12.7; 4b: 6.8–37.8; 4c: 21–91.9	88.7–97.9
Risk of malignancy	0	0	1.7	4a: 3.3; 4b: 9.2; 4c: 44.4–72.4	87.5

* Data are ranges of the fitted probability of a nodule being malignant based on an equation derived from US features.

† The fitted probability for malignancy was calculated as follows: exp(equation)/[1 + exp(equation)], where the equation = −3.8809 + (0.5852 × US1) + (0.6702 × US2) + (1.3424 × US3) + (1.6081 × US4) + (2.7320 × US5) + (1.7764 × US6) + (0.3466 × US7) + (1.2981 × US8). US1: solid composition = 1, mixed composition = 0; US2: hypoechogenicity = 1, other echogenicity = 0; US3: marked hypoechogenicity = 1, other echogenicity = 0; US4: microlobulated margin = 1, well-circumscribed or irregular margin = 0; US5: irregular margin = 1, well-circumscribed or microlobulated margin = 0; US6: microcalcification = 1, macrocalcification or no calcification = 0; US7: macrocalcification = 1, microcalcification or no calcification = 0; US8: taller-than-wide shape = 1, wider-than-tall shape = 0.

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TI-RADS
Categorias

- 1 – Negativo (exame normal)
- 2 – Benigno
- 3 – Provavelmente benigno
- 4 – Suspeito para malignidade
  - 4a: baixa suspeição para malignidade
  - 4b: suspeição intermediária para malignidade
  - 4c: alta suspeição, mas ainda não clássica para malignidade
- 5 – Fortemente suspeito para malignidade
- 6 - Diagnóstico já confirmado por citologia

TI-RADS	1	2	3	4a	4b	4c	5
Risco de malignidade (%)	0	0	1,7	3,3	9,2	44 a 72	88

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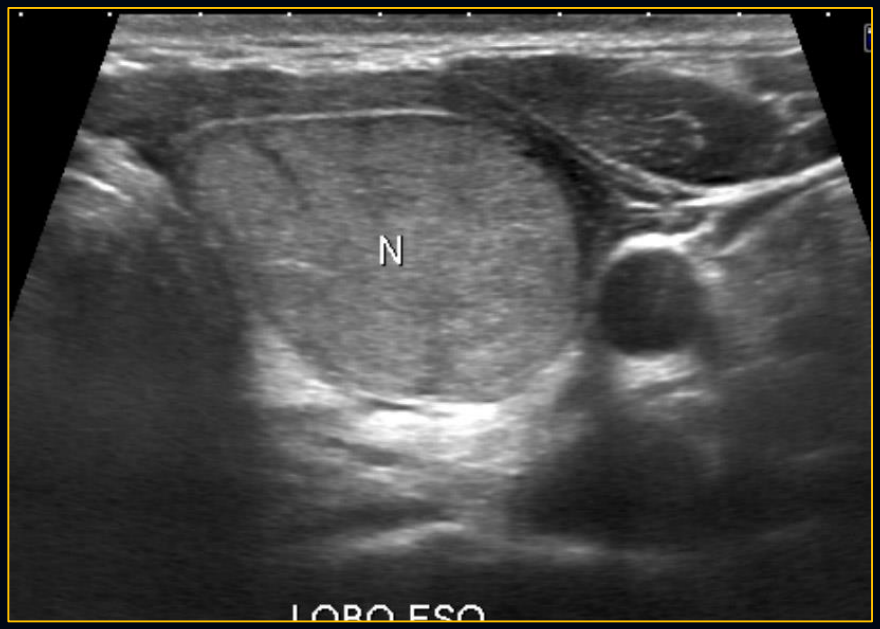
TI-RADS
Cinco sinais maiores de suspeição

- - conteúdo sólido (não misto)
- - nódulo significativamente hipoecoico
- - microcalcificações
- - margens irregulares
- - mais alto do que largo



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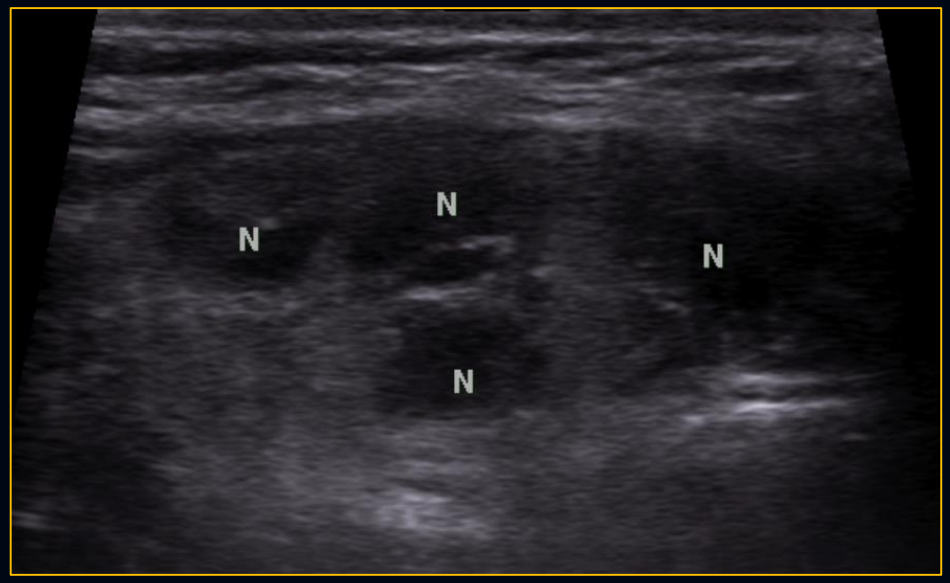

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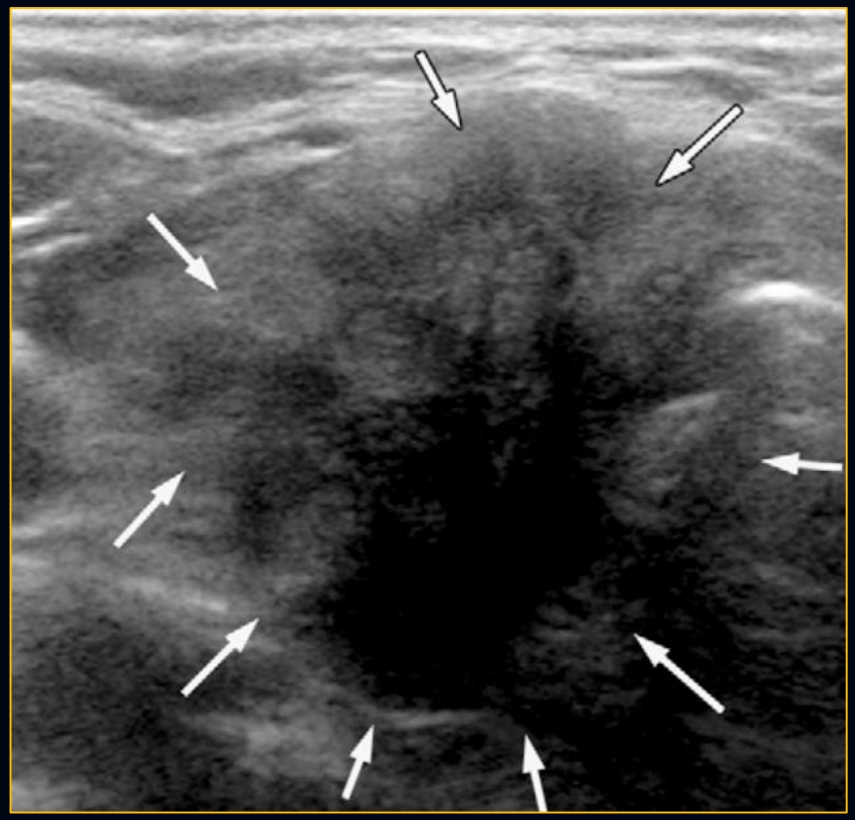

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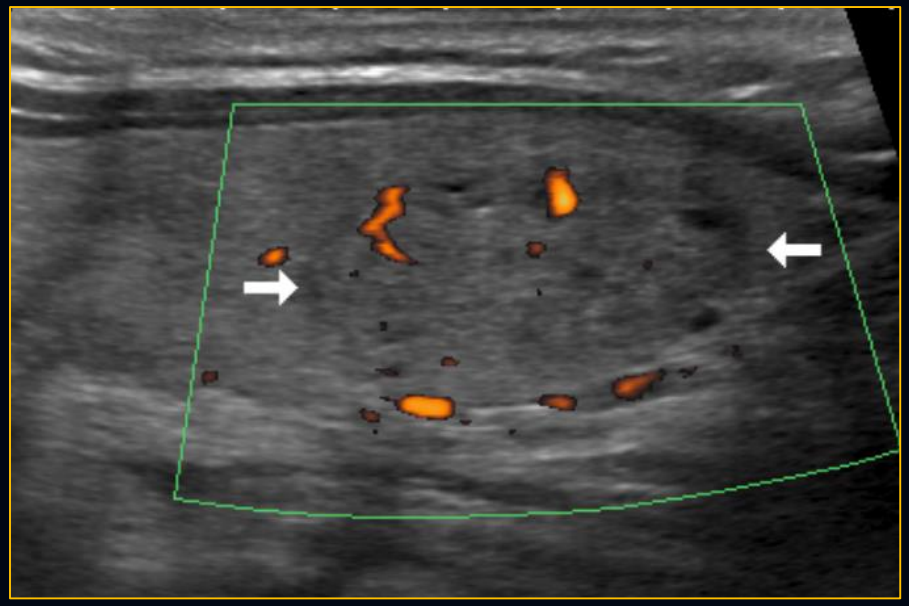
TI-RADS
4 e 5

- TI-RADS 4a – um sinal maior
- TI-RADS 4b – dois sinais maiores
- TI-RADS 4c – 3 ou 4 sinais maiores
- TI-RADS 5 – cinco sinais maiores

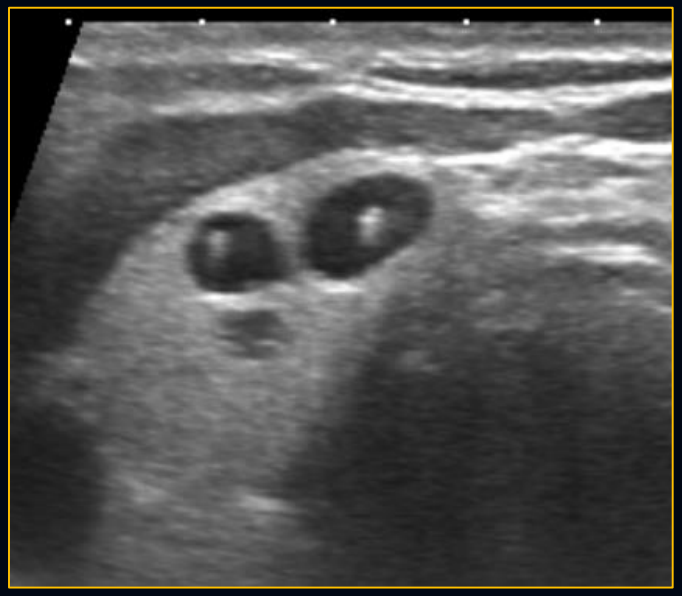
TI-RADS
3

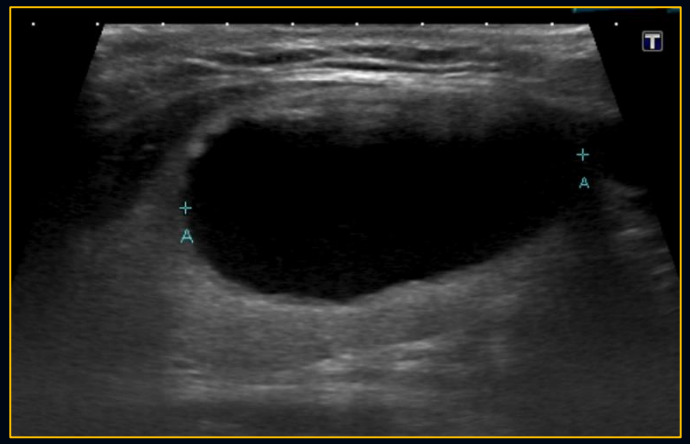
- nódulos isoecoicos ou hiperecoicos na ausência dos cinco sinais maiores de suspeição



TI-RADS
2

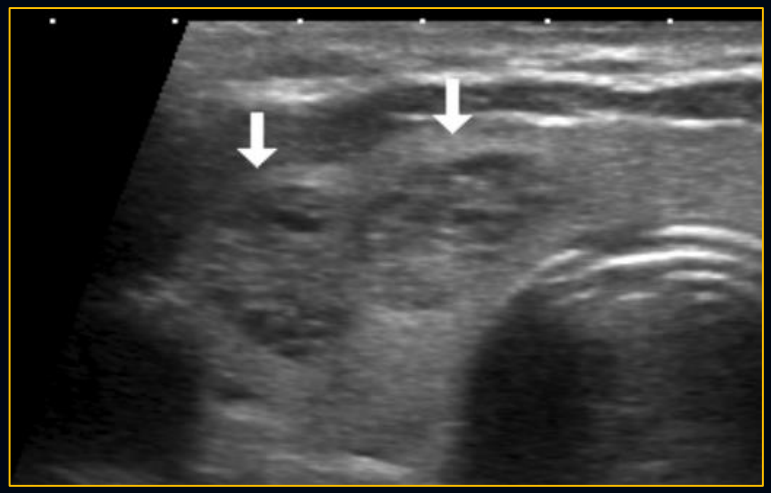
- Lagos coloides com focos hiperecoicos com ou sem artefatos em “cauda de cometa”
- Lesões císticas espongiformes
- Nódulos “White Knight”
- Macrocalcificações isoladas
- Tireoidite subaguda típica (lesões hipoecoicas, múltiplas, em contexto de dor à palpação e tireotoxicose)





TI-RADS
2

- Lagos coloides com focos hiperecoicos com ou sem artefatos em “cauda de cometa”
- Lesões císticas espongiformes
- Nódulos “White Knight”
- Macrocalcificações isoladas
- Tireoidite subaguda típica (lesões hipoecoicas, múltiplas, em contexto de dor à palpação e tireotoxicose)



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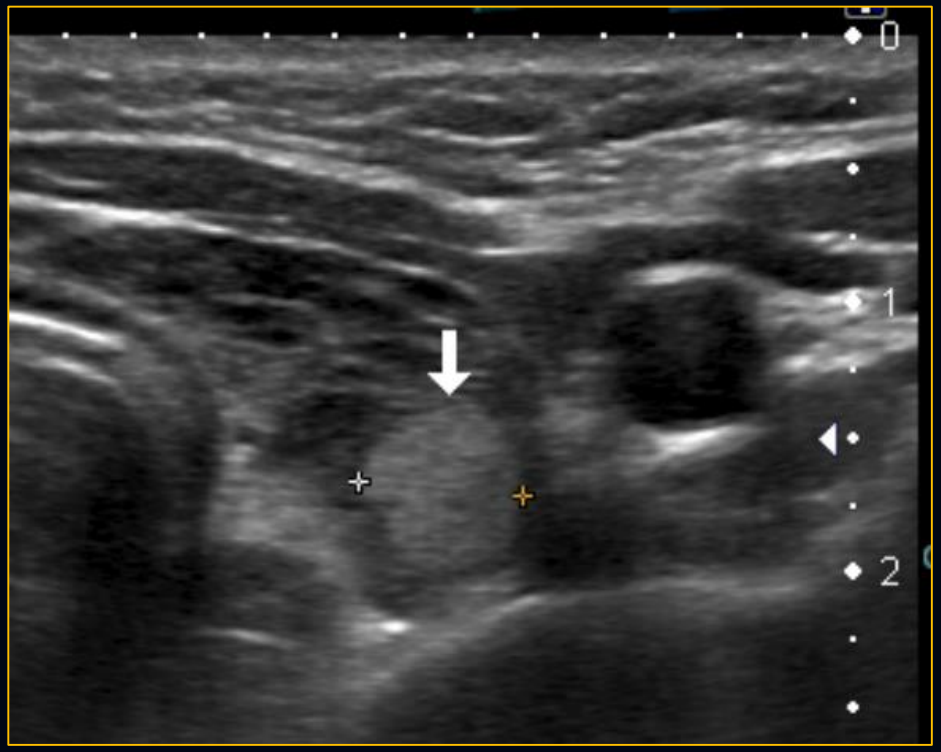

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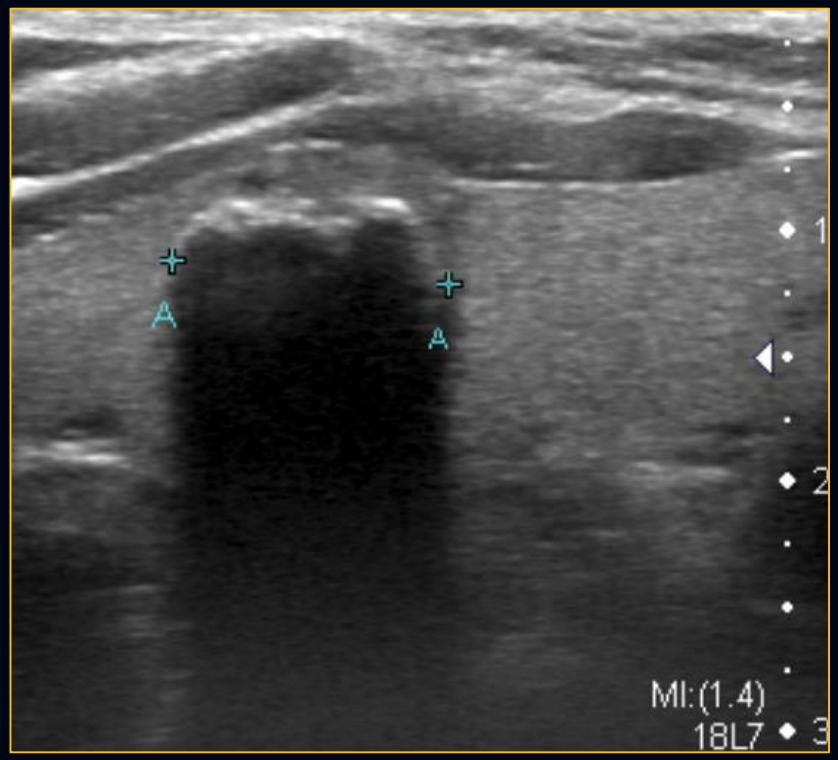

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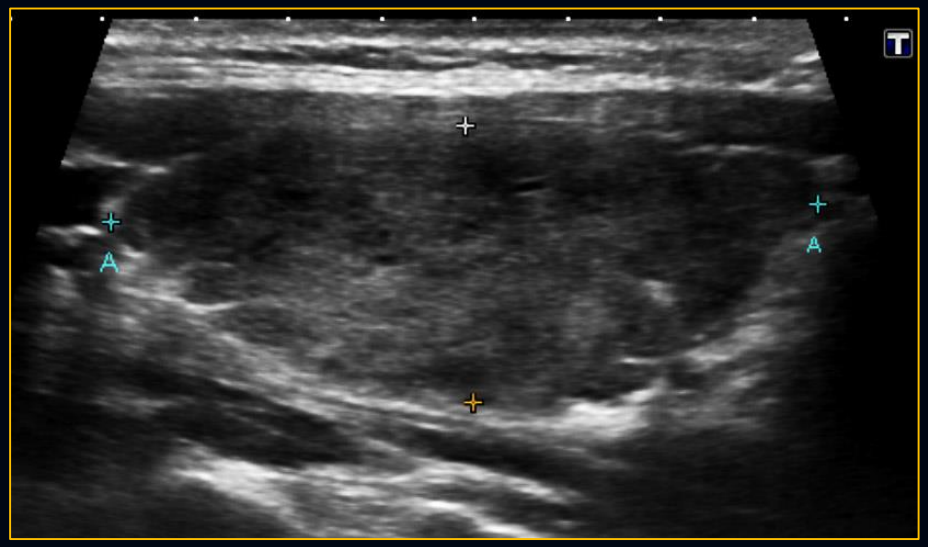
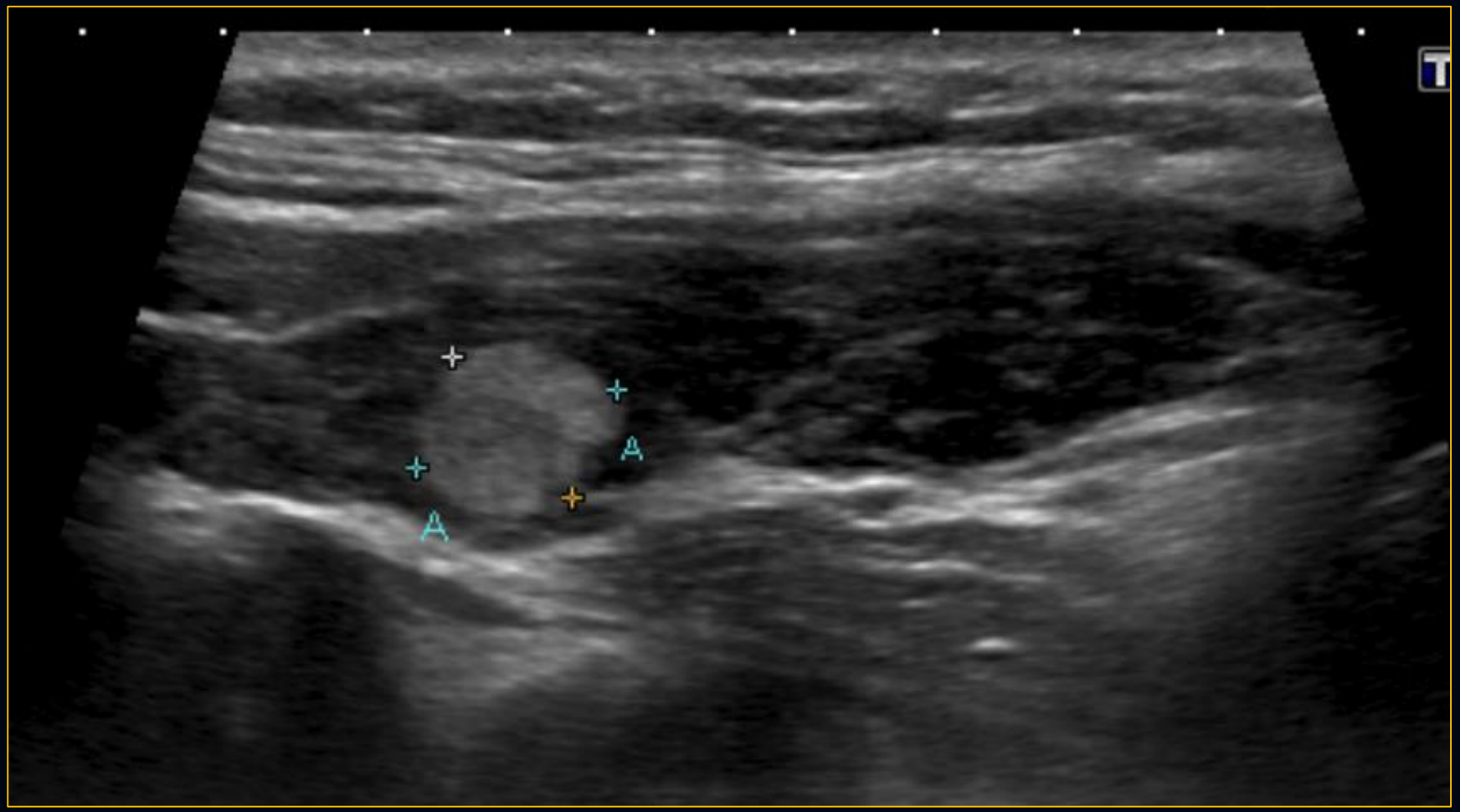


TI-RADS
Categorias - Revisão

- 1 – Normal
- 2 – Benigno
  - Cistos, lesões espongiformes, nódulo “white knight”, calcificações isoladas
- 3 – Provavelmente benigno
  - Nódulos que não possuem critérios maiores de suspeição
- 4 e 5 - Suspeitos
  - Apresentam de 1 a 5 critérios maiores de suspeição
    - - conteúdo sólido (não misto)
    - - nódulo significativamente hipoecoico
    - - microcalcificações
    - - margens irregulares
    - - mais alto do que largo
- 6 - Diagnóstico já confirmado por citologia

Caso 1



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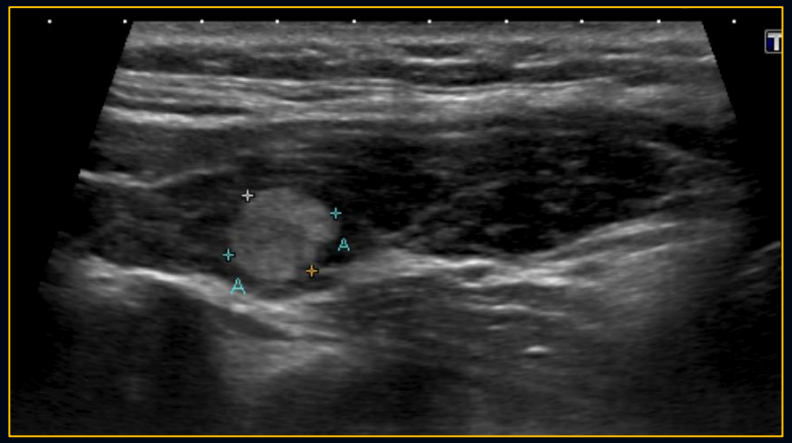

- Qual a categoria do TI-RADS desse nódulo?
- A) 2
- B) 3
- C) 4a
- D) 4b
- E) 4c

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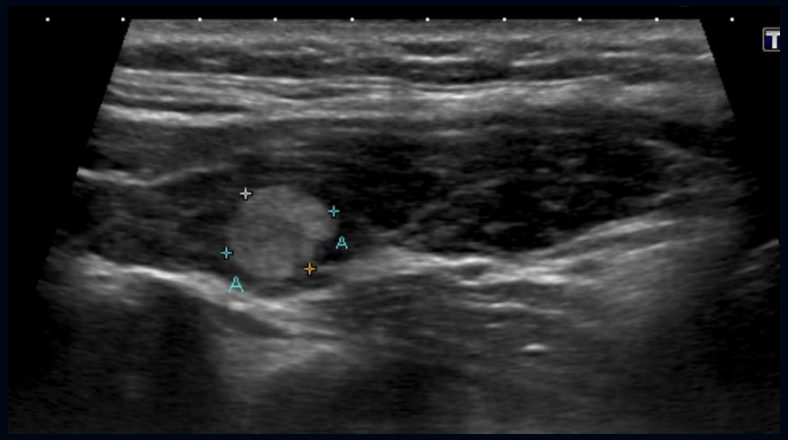

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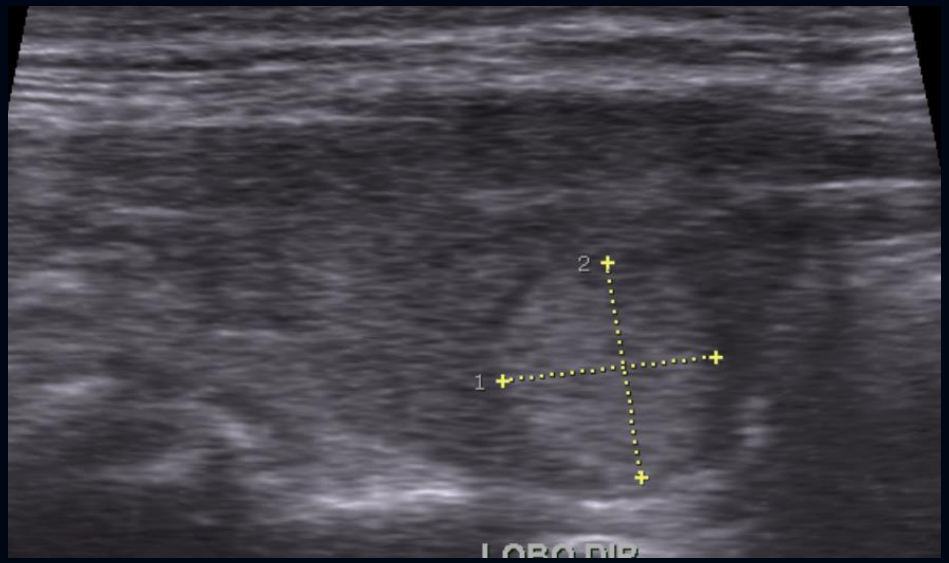
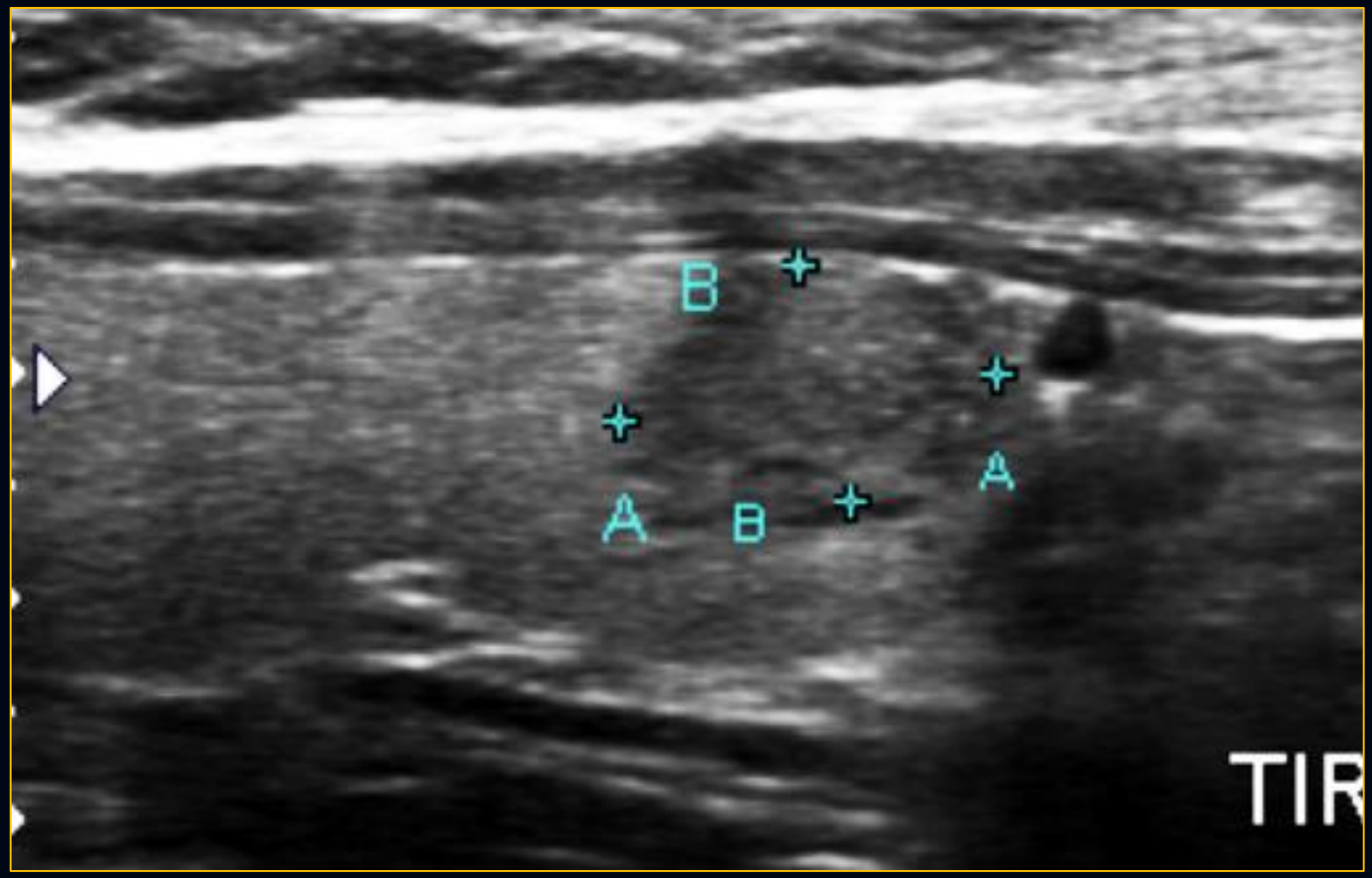
Nódulo “White Knight”

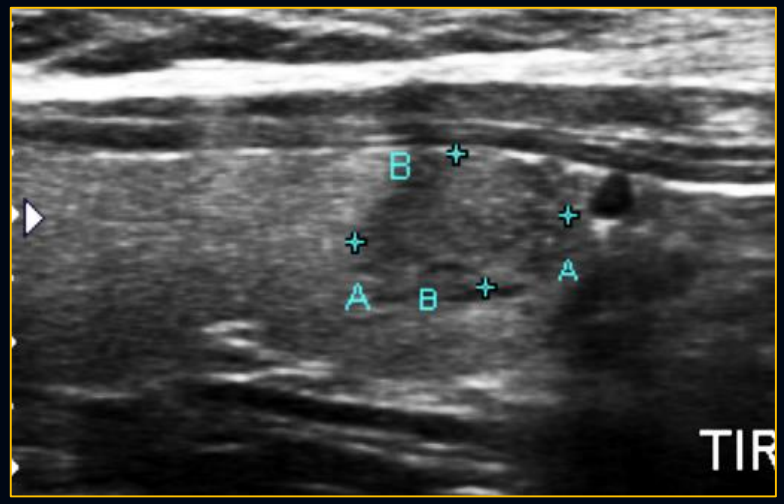
- Nódulo hiperecoico em um parênquima tireoideo difusamente hipoecoico, geralmente por tireoidite crônica.
- Esses nódulos são geralmente benignos, sem riscos de maliginidade.



Caso 2

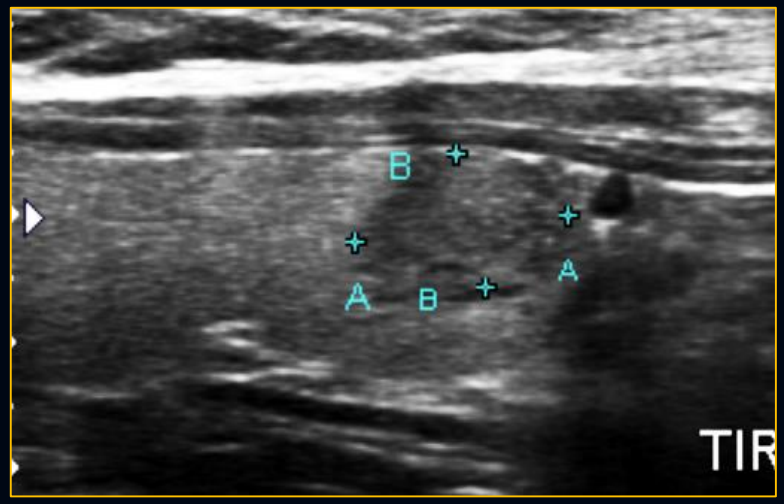


Caso 2



- Qual a categoria do TI-RADS desse nódulo?
- A) 3
- B) 4a
- C) 4b
- D) 4c
- E) 5

Caso 2



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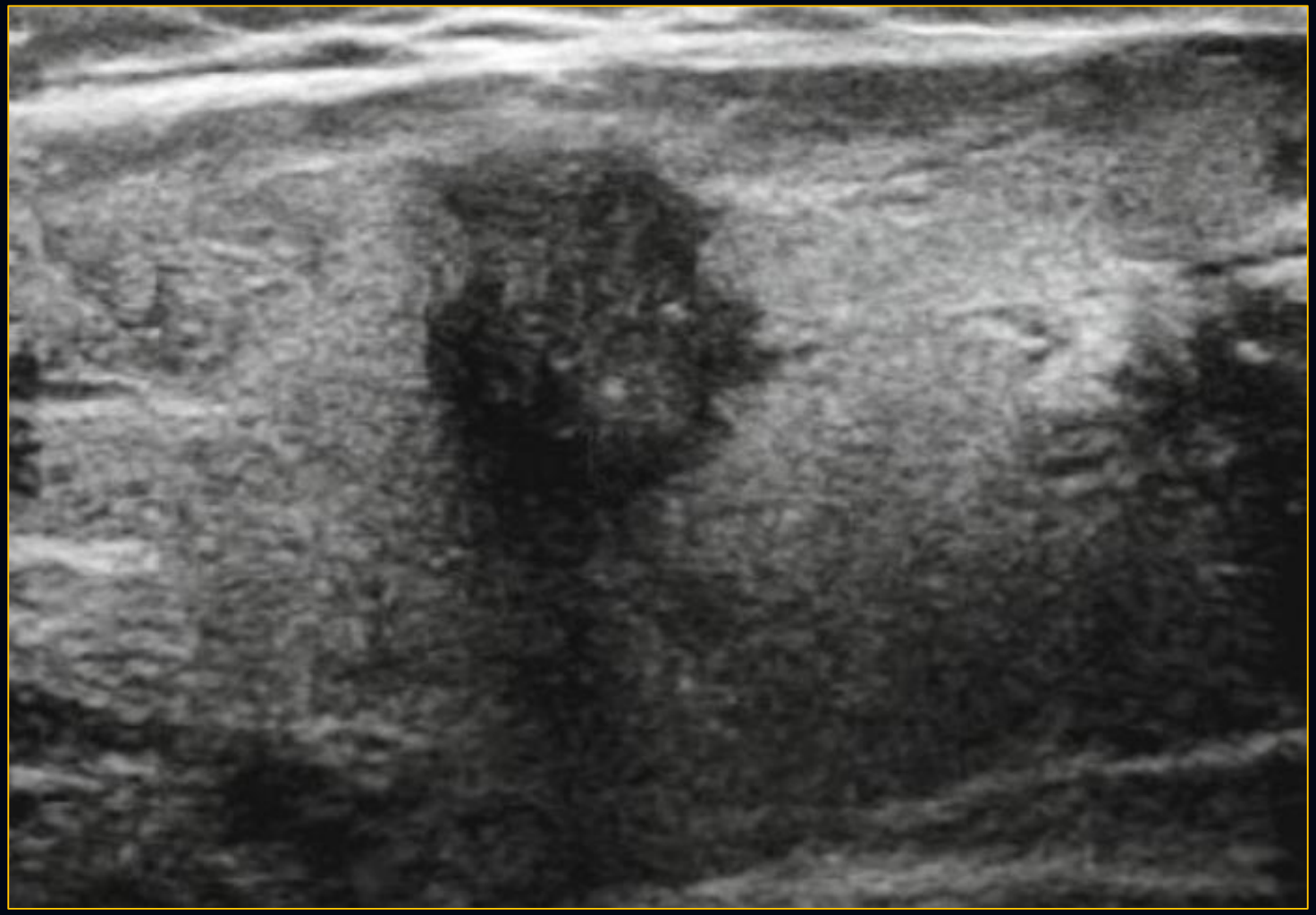
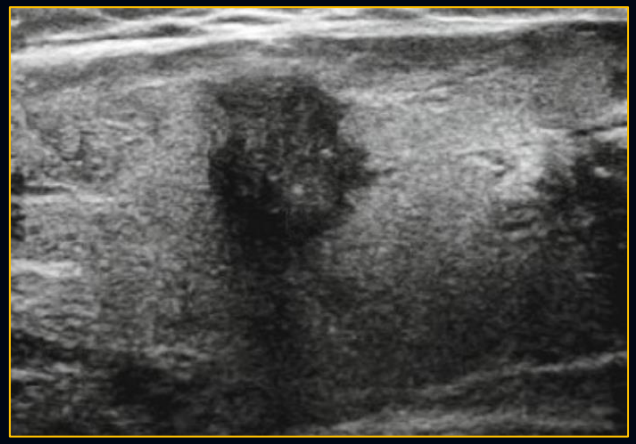
Caso 3



Caso 3



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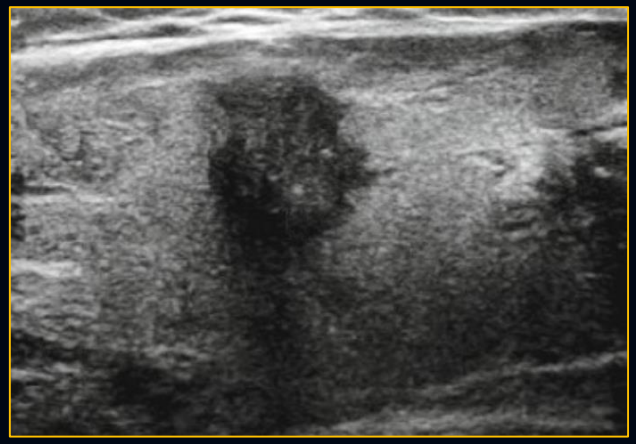

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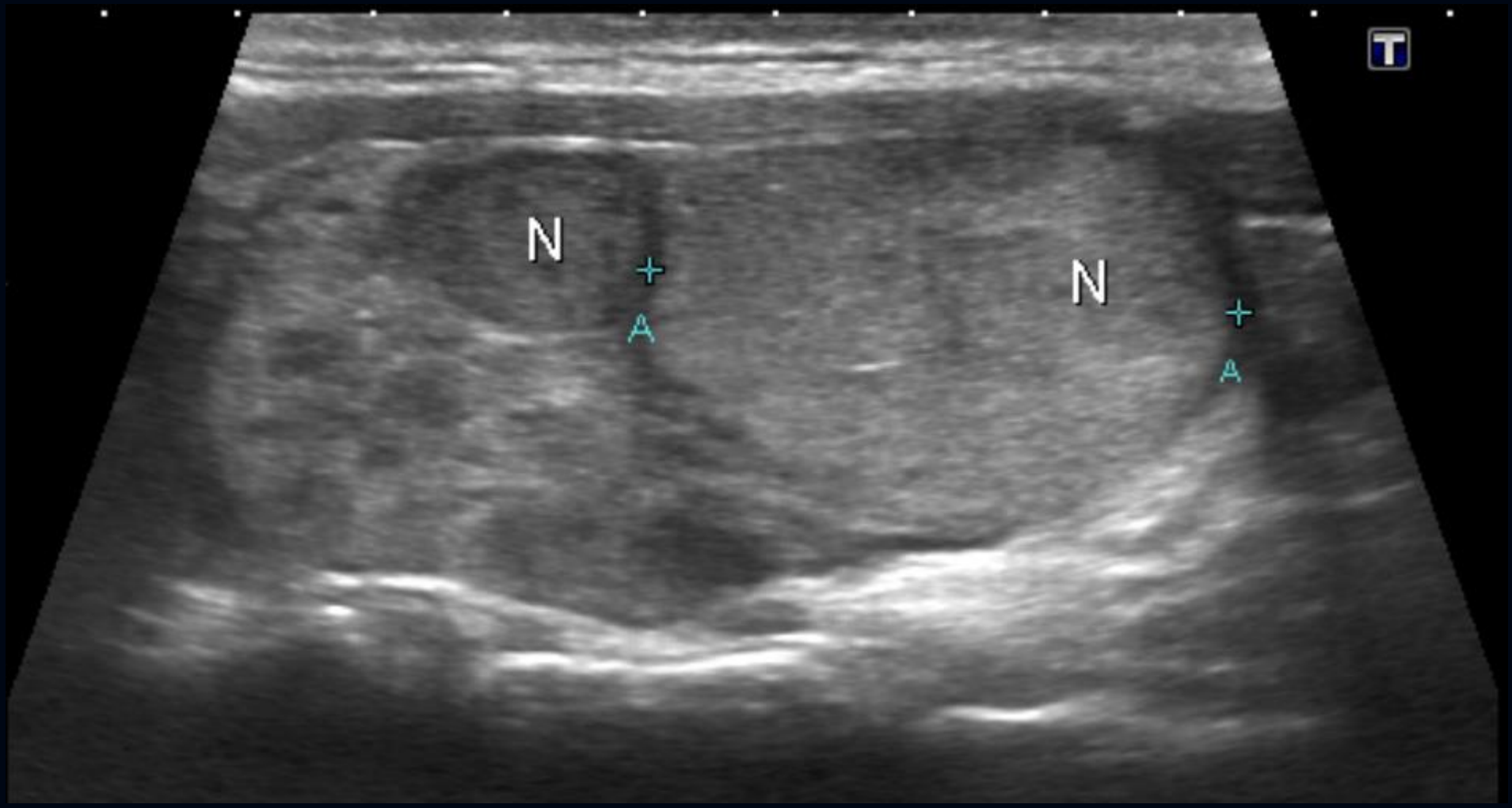
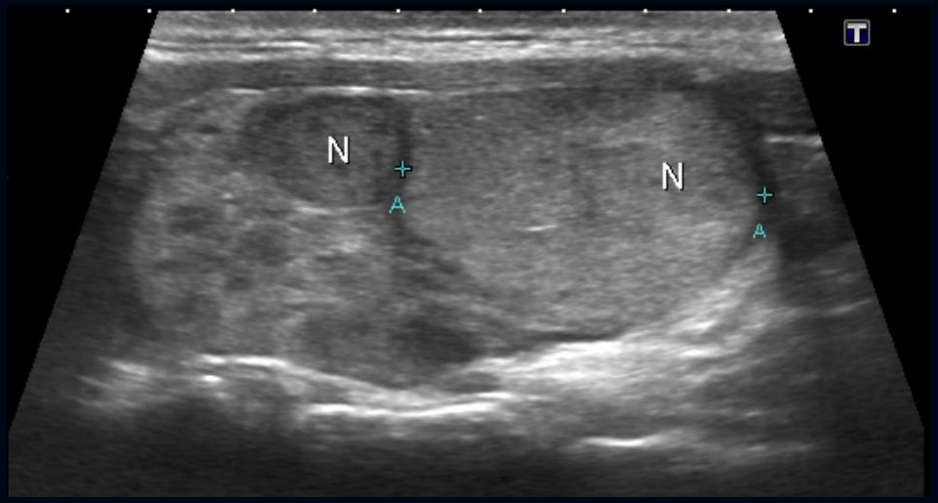
Caso 4

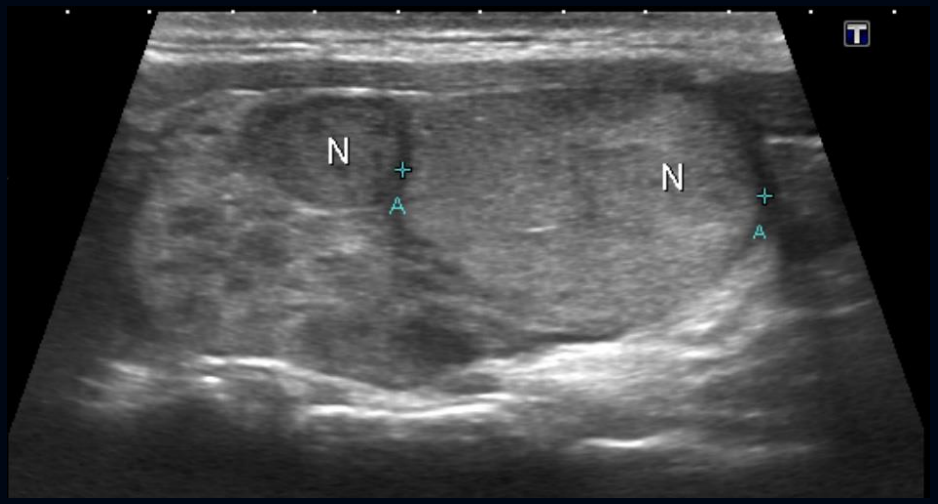


Caso 4



- Qual a categoria TI-RADS dos nódulos menor e maior, respectivamente?
- A) 3 e 4a
- B) 4a e 3
- C) 4a e 4a
- D) 4b e 4a
- E) 4b e 4b

Caso 4



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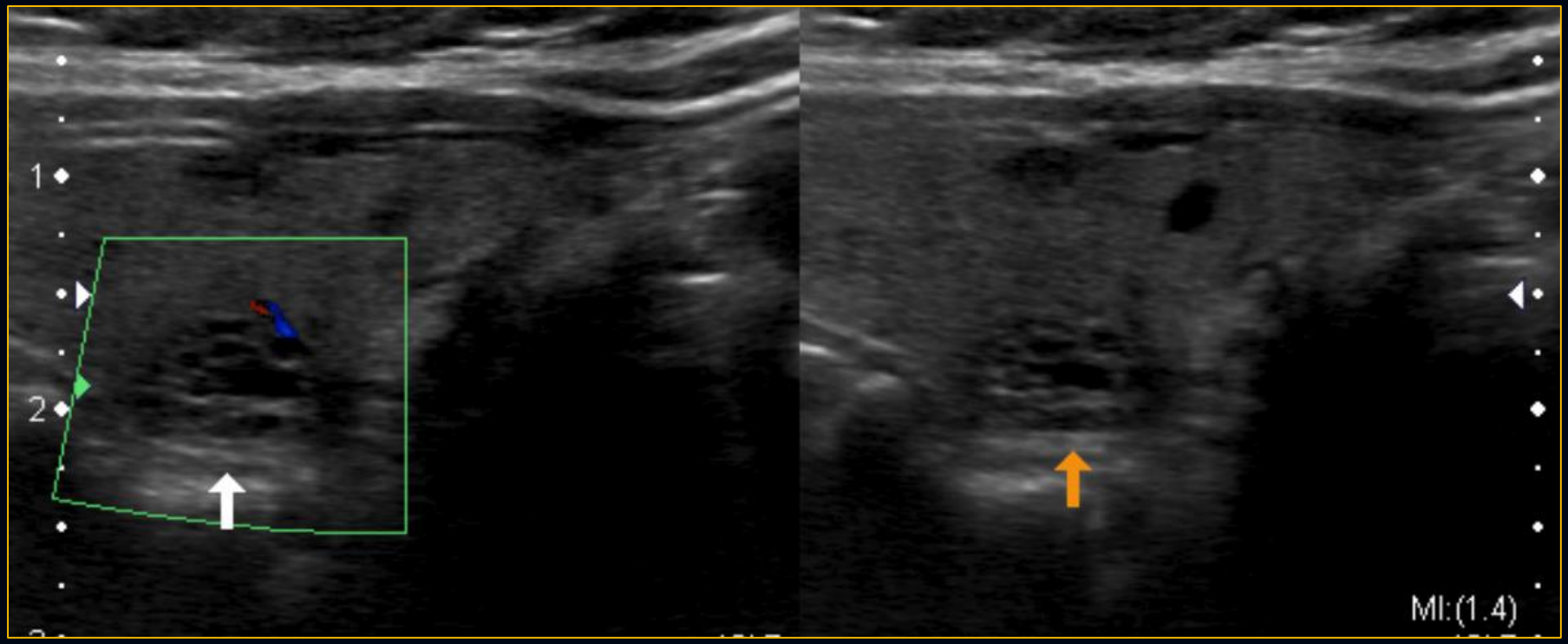
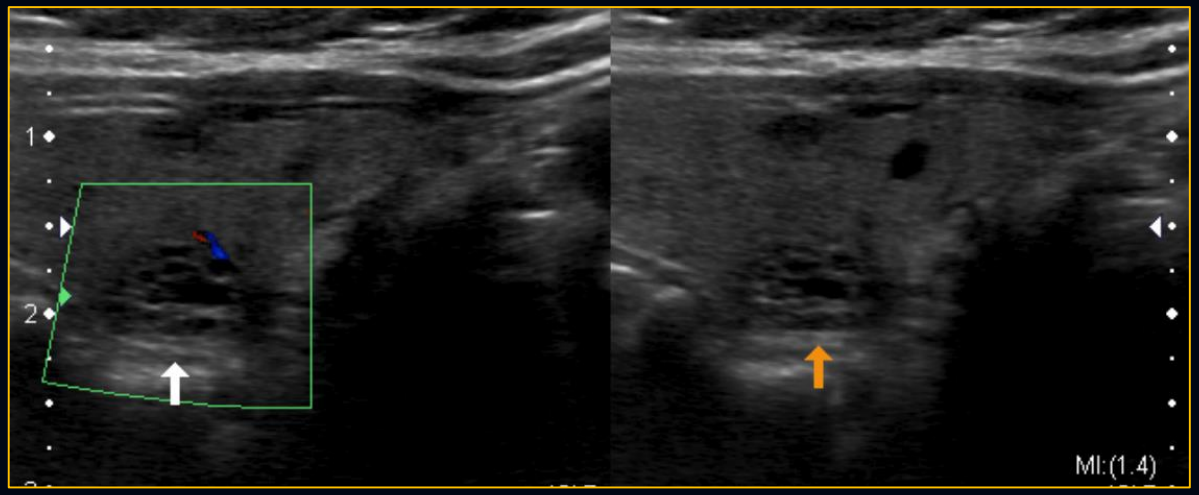
- C) 4a e 4a
- D) 4b e 4a
- E) 4b e 4b

Caso 5

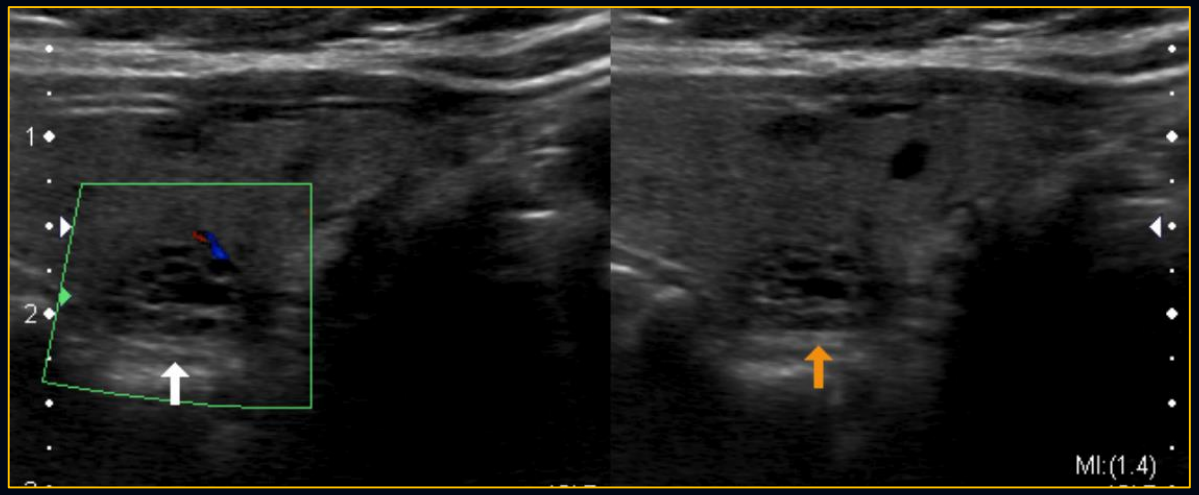


Caso 5



- Qual a categoria TI-RADS do nódulo apontado nessas imagens?
- A) 2
- B) 3
- C) 4a
- D) 4b
- E) 4c

Caso 5



- Qual a categoria TI-RADS do nódulo apontado nessas imagens?
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- B) 3
- C) 4a
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Críticas ao TI-RADS

- Não existe ainda consenso sobre a classificação.
- Alguns autores sugerem que a presença de linfonodomegalia determinaria maior suspeição para malignidade.
- Ausência de léxico e falta de padronização dos achados ultrassonográficos.
- Ainda não é capaz de padronizar a conduta.
- As dimensões não constituem critério para classificação
- A classificação está baseada apenas na ultrassonografia, não considerando outras modalidades diagnósticas, tais como o PET-CT e a cintilografia.

Contato:
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