



Shape of the nodule –
the nonparallel orientation
Characteristics of thyroid nodules

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www.thyrosite.com

2020

Syllabus

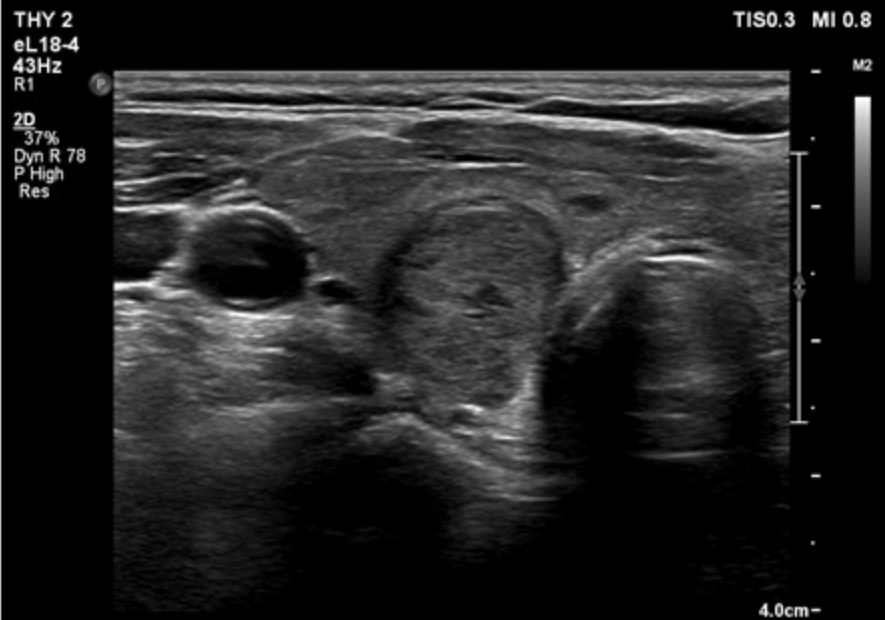
1. What does it mean irregular shape of the nodule?
2. The importance of the sign in the differential diagnostics.
3. Difficult-to-judge patterns.

Definition of irregular shape

1. Equivalent with nonparallel orientation:
the depth exceeds the width and/or depth of the nodule.
2. A characteristics which relies on the infiltrative nature of papillary thyroid cancer similar to irregular borders and extrathyroidal extension
3. Irregular shape = nonparallel orientation
 - taller-than-wide shape – measured in transverse scan
 - taller-than-long shape – measured in longitudinal scan

Horizontal view

Horizontal view



Case 2095



Longitudinal view

10/10/2019 19:14



Case 2169



Longitudinal view

Definition of irregular shape

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Definition of nonparallel orientation

1. How to measure?

Calculated by dividing the anteroposterior diameter by the transverse diameter.

2. What does it mean?

ratio of the former is > 1 (*Moon-2011*)

3. In which plane has to be measured? In the transverse or in the longitudinal one?

„A taller-than-wide shape **in either transverse or longitudinal** plane, was most accurate and sensitive for predicting thyroid malignancy.” (*Moon-2011*)

Horizontal view

Horizontal view



Case 873

Case comp 020

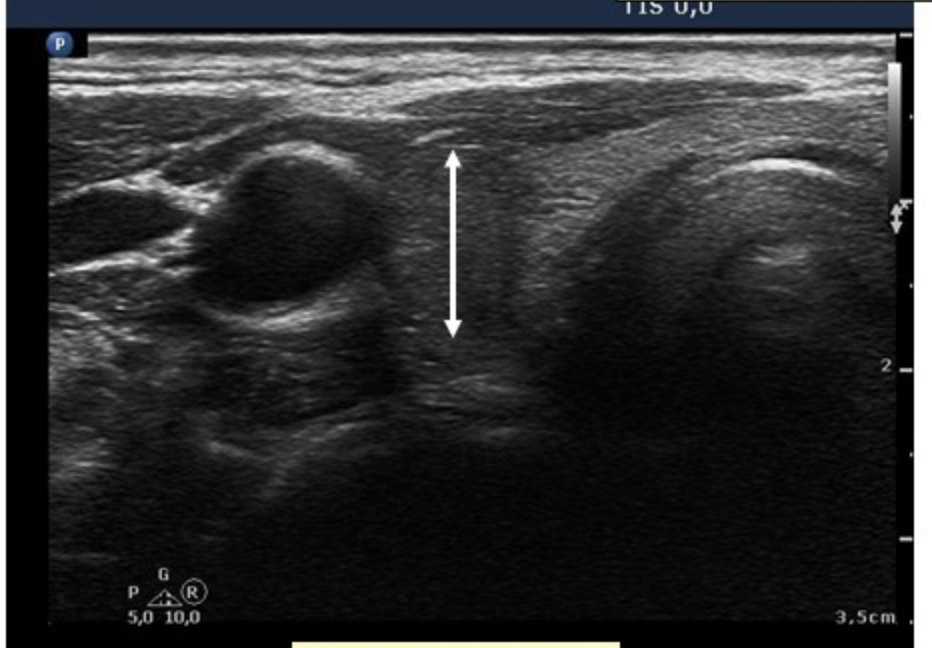


Longitudinal view

Longitudinal view

Horizontal view

Horizontal view



Case 873

Case comp 020

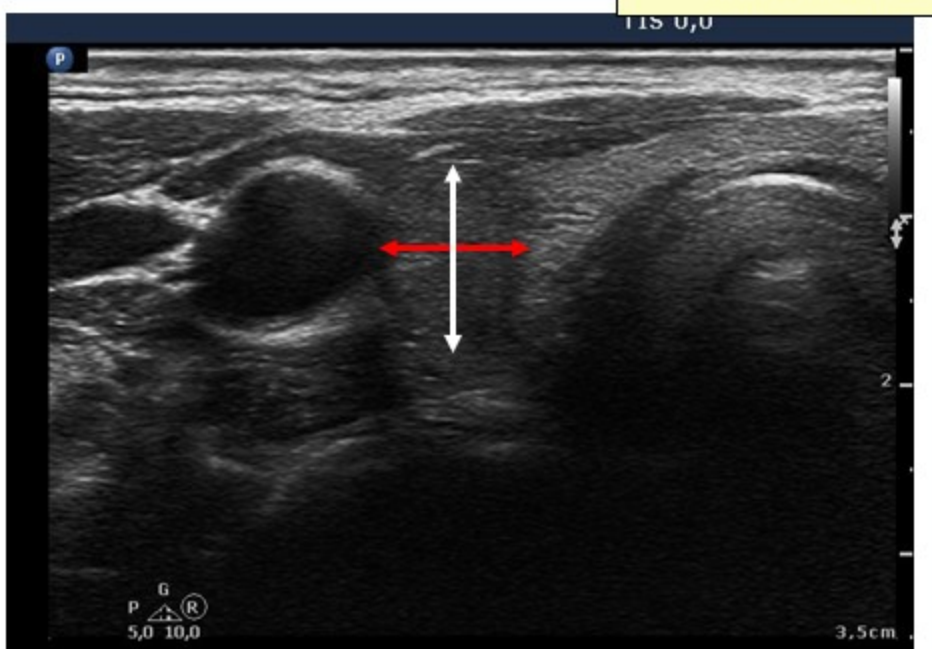
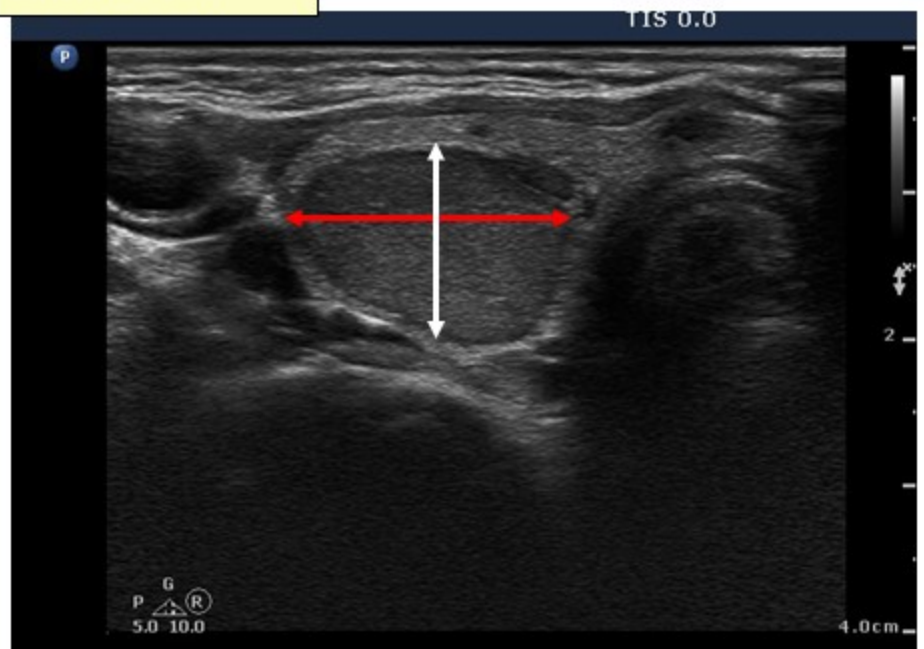


Longitudinal view

Longitudinal view

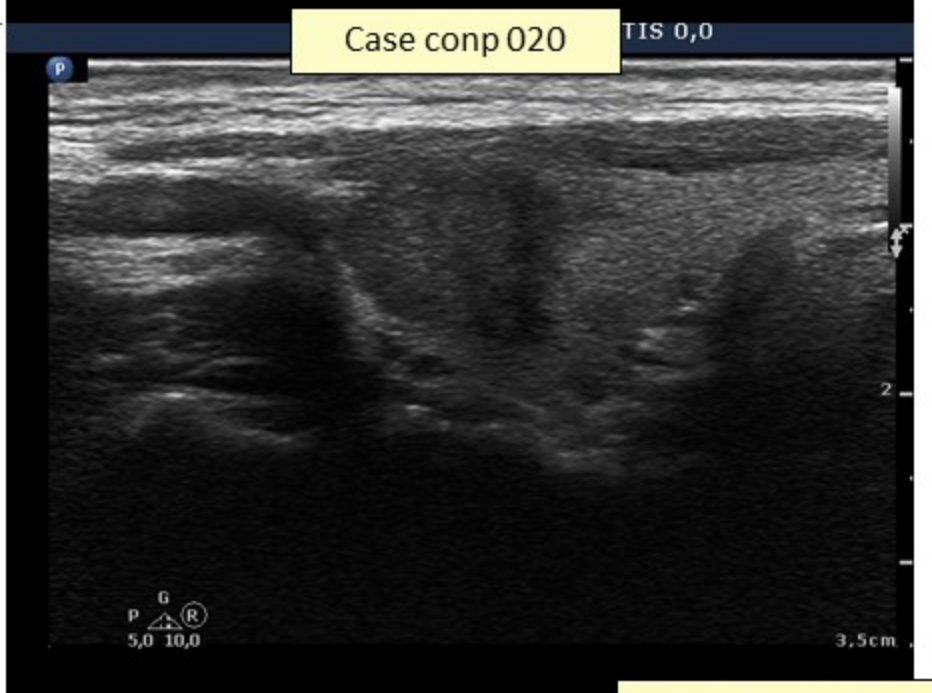
Horizontal view

Horizontal view



Case 873

Case comp 020



Longitudinal view

Longitudinal view

Horizontal view

Horizontal view



Case 873

Case comp 020



Longitudinal view

Longitudinal view

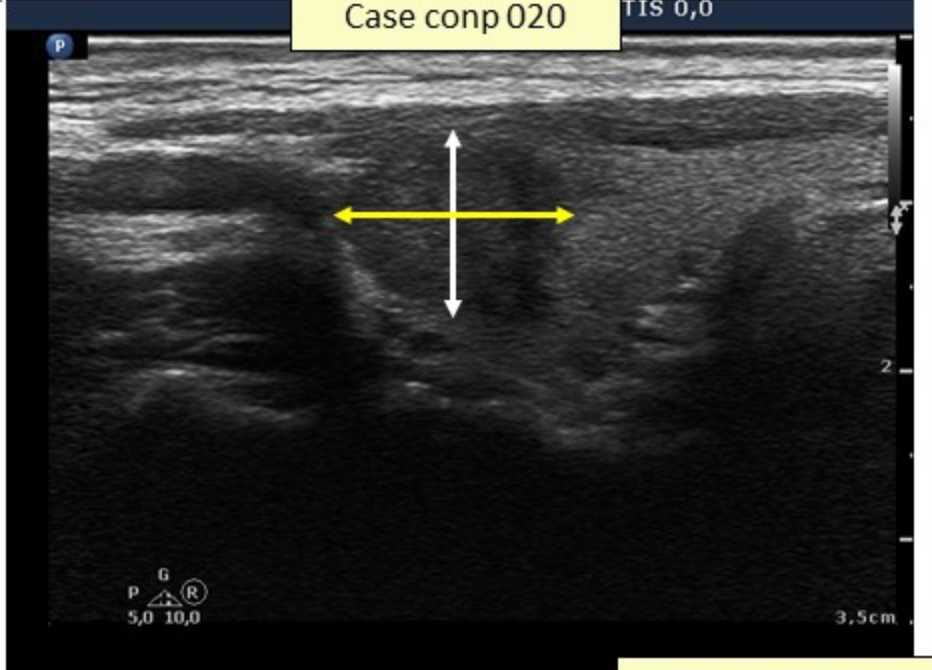
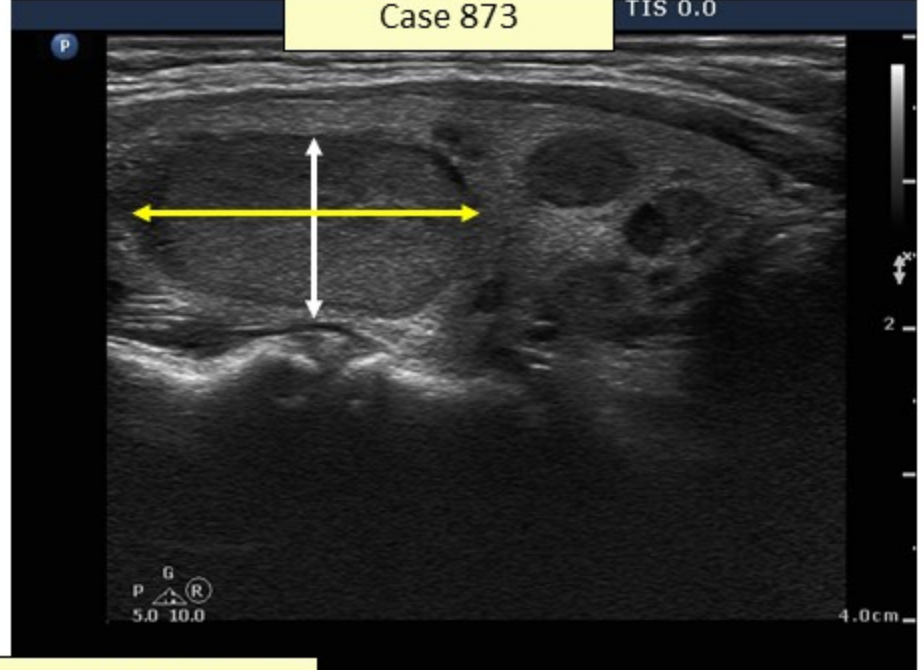
Horizontal view

Horizontal view



Case 873

Case comp 020



Longitudinal view

Longitudinal view

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Calculated by dividing the anteroposterior diameter by the transverse diameter.

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ratio of the former is > 1 (*Moon-2011*)

3. In which plane has to be measured? In the transverse or in the longitudinal one?

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4. By definition the diameters should be compared

Compare the largest diameters and not the diameters in a single section.

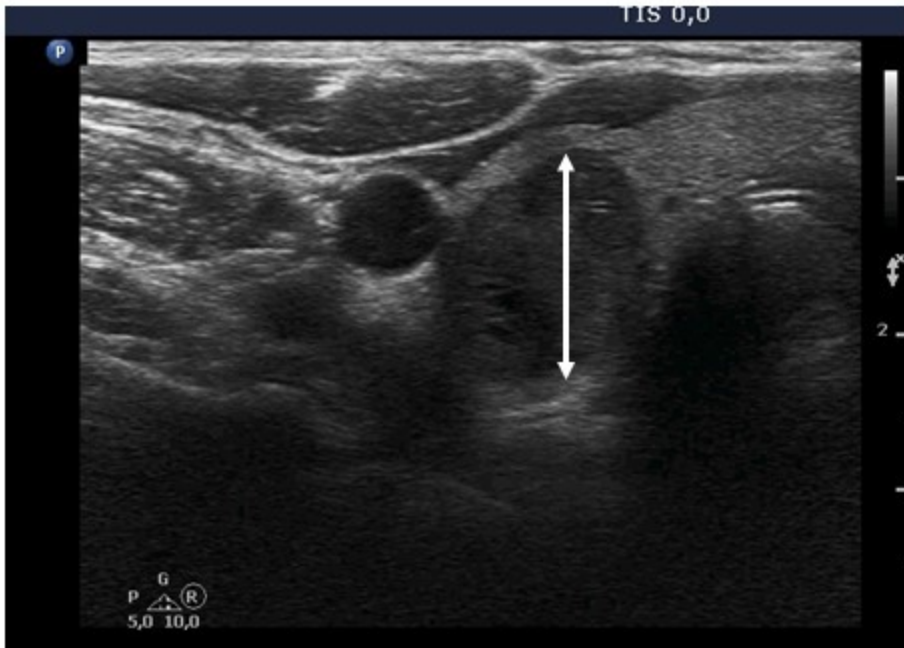


Case 2116



Case 2251

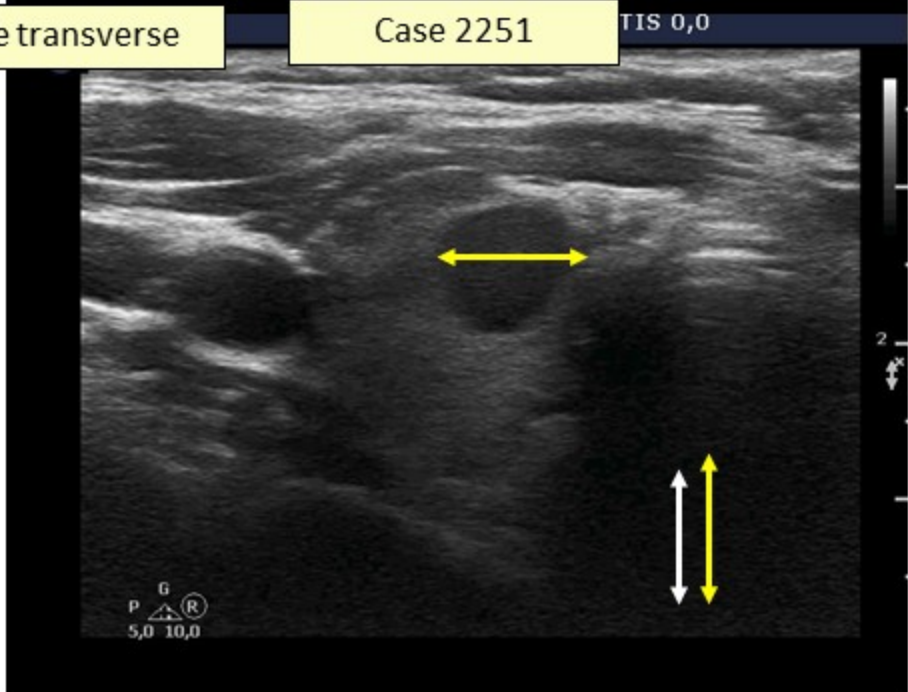
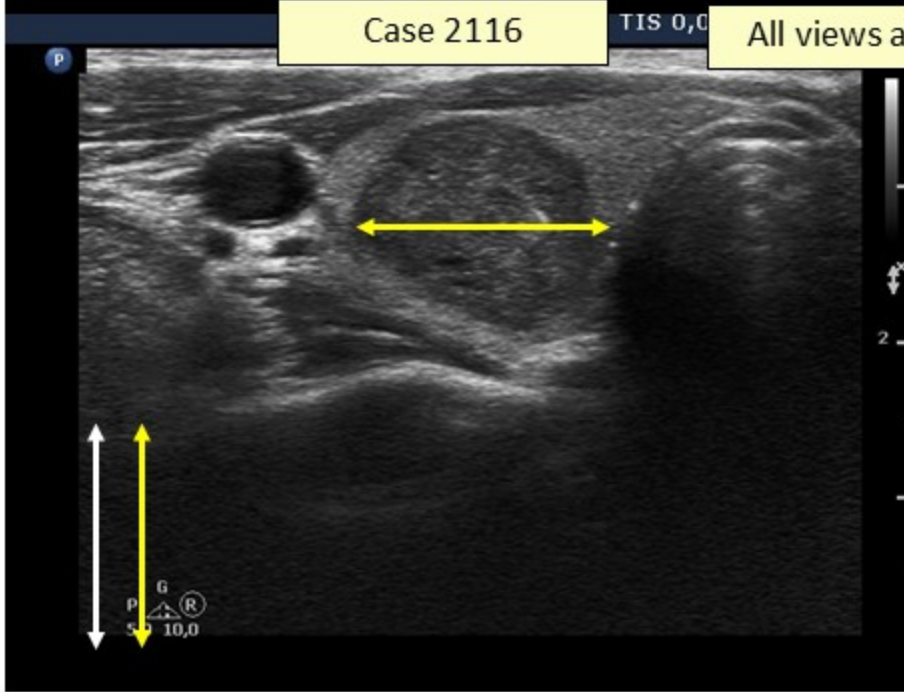
All views are transverse



Case 2116

TIS 0,0 All views are transverse

Case 2251



Nonparallel orientation of a nodule

The depth (antero-posterior) to width ratio is > 1 .

The finding indicates that malignant nodules grows across the normal tissue plane in a centrifugal manner, while benign nodules do the same in a parallel fashion (*Kim-2002, Alexander-2004, Stavros-1995*).

Triggered by ultrasound compression of the thyroid gland - benign nodules are easier to compress than malignant ones (*Yoon-2009*)

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Triggered by ultrasound compression of the thyroid gland - benign nodules are easier to compress than malignant ones (*Yoon-2009*)

Some confusions regarding the definition.

- In which axis to measure the ratios?
Only the taller-than wide (measured in transverse scan) shares importance or both the taller-than-wide and the taller-than-length signs count.
- An arbitrary chosen value vs. reality
- The term 'Nonparallel orientation' is preferred to 'taller-than-wide shape'.

Differences in the definition of nonparallel orientation among professional societies

	How to hold the transducer in transverse scan?	Which sections count?
European Thyroid Association (<i>Russ-2017</i>)	Not mentioned	Both the transverse and the longitudinal.
Korean Society of Thyroid Radiologist (<i>Shin-2016</i>)		
AACE/ACE/AME (<i>Gharib-2016</i>)		Table 4: only the transverse section 3.3.3: both sections
ATA (<i>Haugen-2016</i>)		Only the transverse
American College of Radiology (<i>Tessler-2017</i>)	Axial	

The impact of nonparallel orientation on the grouping of the nodule in various TIRADS

Type of TIRADS	Echogenicity of the nodule	Nonparallel orientation present
AACE	Irrelevant	3
ACR		4 or 5
ATA	Non-hypoechoic	Non-classifiable
	Hypoechoic	5
European	Irrelevant	5
Korean	Isoechoic	4
	Hypoechoic	5

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The diagnostic importance of nonparallel orientation in the diagnosis of thyroid cancers

1. Nonparallel orientation is an **insensitive** sign but has the **highest specificity** for thyroid malignancy among suspicious features.
2. The **specificity** ranges from **88.4% to 98.7%** (*Brito-2014, Kwak-2011, Lee-2009, Na-2016*).

	Odds ratio (95% CI)	Cohort of patients
Kwak-2013	2.3 (1.6-3.3)	732 malignant lesions
Campanella-2014	10.2 (6.7-15.3)	29,678 nodules (metaanalysis)
Brito-2014	11.1 (6.6-18.9)	18,288 nodules (metaanalysis)

Nonparallel shape in various subtypes of thyroid cancers

	Occurrence – range (%)	Occurrence – median (%)
Follicular	0 - 26.1	4.1
Medullary	2.9 - 63.1	28.9
Papillary	9.6 - 74.0	36.4

For references see Manual.

Some differential diagnostic issues

1. The influence of the normal anatomy of the thyroid
 - nonparallel orientation of a lobe

Nonparallel shape in diffuse thyroid diseases

/Table 1 in *Baek-2019*/

Association between various ultrasonography features and diffuse thyroid disease.

US features	No. of NTP (<i>n</i> = 193) [*]	No. of DTD (<i>n</i> = 77) [*]	Univariate analysis		Multivariate analysis	
			Odds Ratio [†]	P value [‡]	Odds Ratio [†]	P value [§]
Echogenicity				<0.001		
normal (<i>n</i> = 241)	186 (77.2)	55 (22.8)	1		1	
decreased (<i>n</i> = 23)	6 (26.1)	17 (73.9)	9.58 (3.6, 25.48)		1.31 (1.06, 4.91)	0.047
increased (<i>n</i> = 6)	1 (16.7)	5 (83.3)	16.91 (1.93, 147.8)		2.94 (1.37, 26.45)	0.029
Echotexture				<0.001		
fine (<i>n</i> = 188)	169 (89.9)	19 (10.1)	1		1	
coarse (<i>n</i> = 82)	24 (29.3)	58 (70.7)	21.49 (10.98, 42.08)		9.57 (4.42, 20.48)	<0.0001
AP diameter				<0.001		
normal (<i>n</i> = 252)	188 (74.6)	64 (25.4)	1		1	
decreased (<i>n</i> = 5)	4 (80)	1 (18)	0.73 (0.08, 6.69)		0.73 (0.12, 10.17)	0.346
increased (<i>n</i> = 13)	1 (7.7)	12 (92.3)	35.25 (4.49, 276.47)		8.66 (2.24, 32.89)	0.002
Margin				<0.001		
smooth (<i>n</i> = 252)	189 (75)	63 (21)	1		1	
lobulated (<i>n</i> = 18)	4 (22.2)	14 (77.8)	10.5 (3.33, 33.07)		3.82 (2.71, 17.26)	0.036
Vascularity				<0.001		
normal (<i>n</i> = 175)	152 (86.9)	23 (13.1)	1		1	
decreased (<i>n</i> = 3)	1 (33.3)	2 (66.7)	13.22 (1.15, 151.67)		6.23 (0.47, 97.82)	0.419

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Some differential diagnostic issues

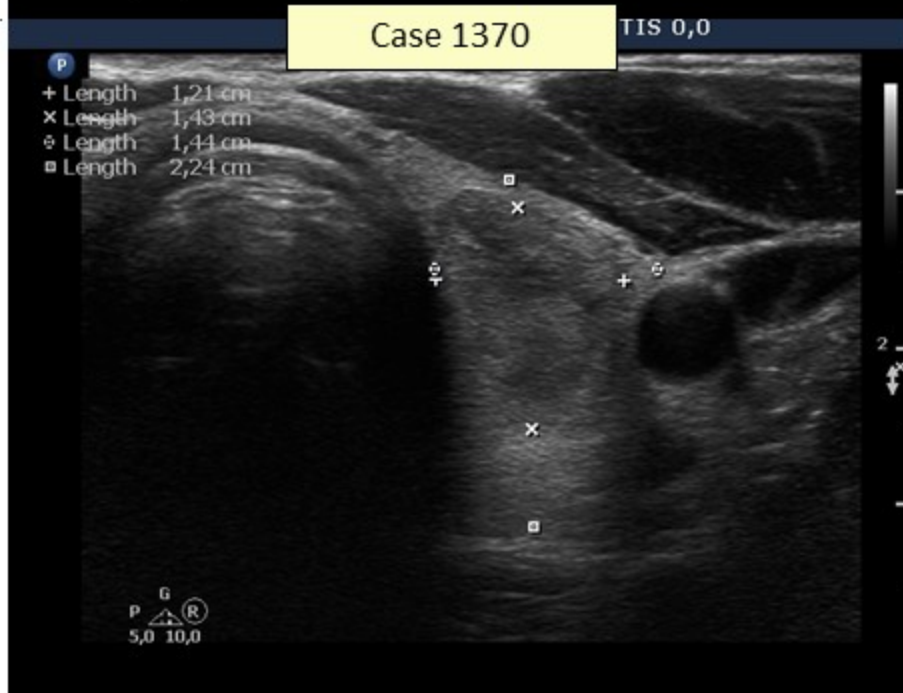
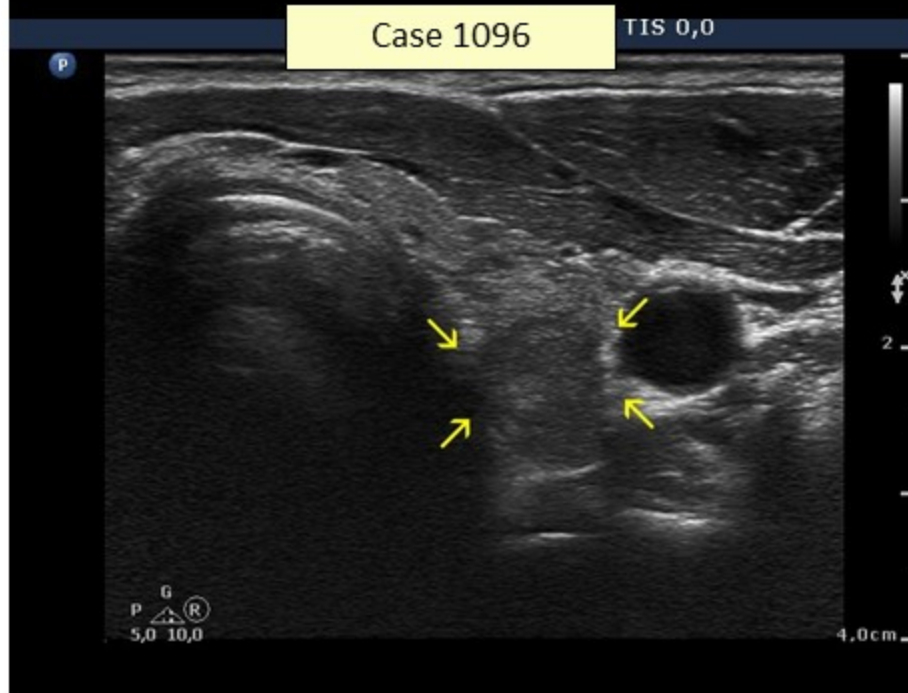
1. The influence of the normal anatomy of the thyroid
 - nonparallel orientation of a lobe



Case 1096



Case 1370



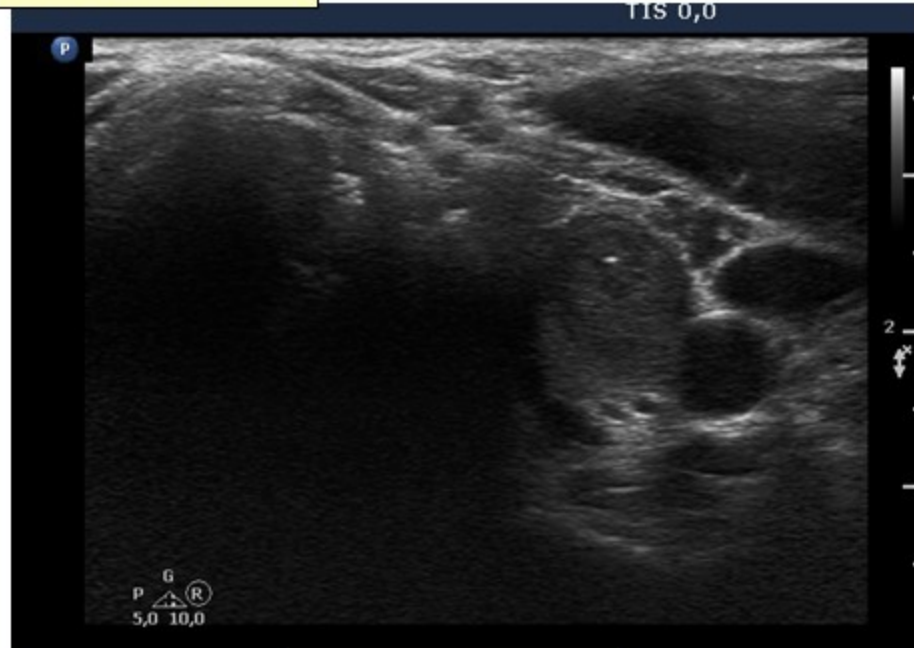
Some differential diagnostic issues

1. The influence of the normal anatomy of the thyroid

- nonparallel orientation of a lobe
- upper pole nodules

Horizontal view

Horizontal view



Case 2051

Case 2052



Longitudinal view

Longitudinal view

Some differential diagnostic issues

1. The influence of the normal anatomy of the thyroid

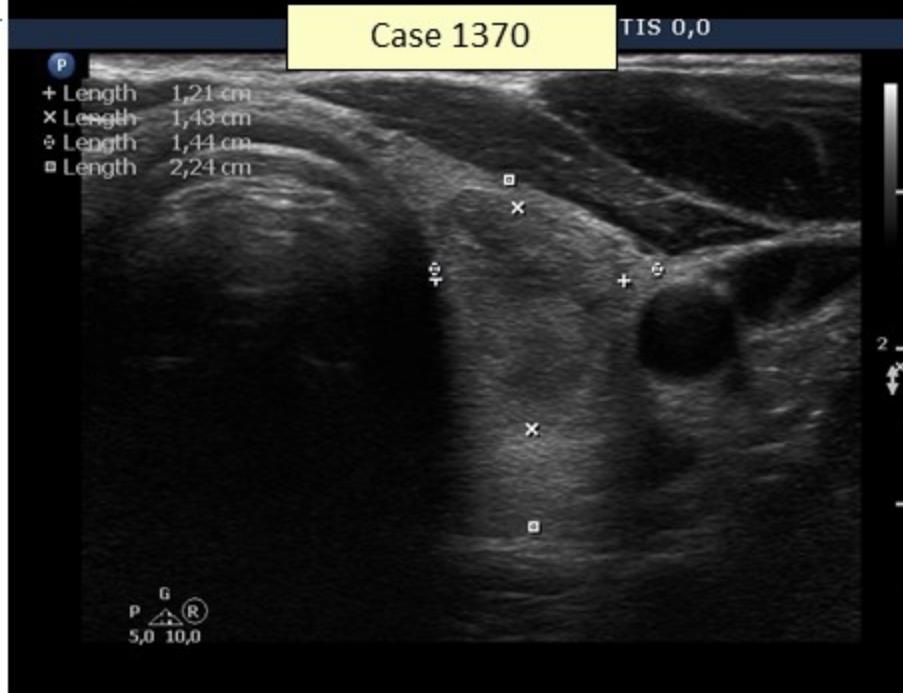
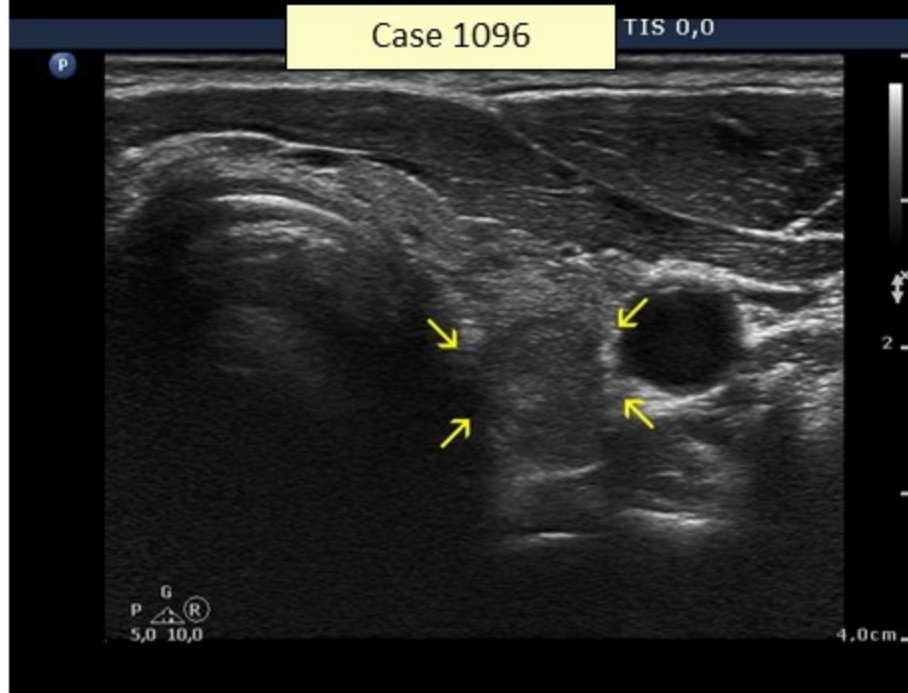
- nonparallel orientation of a lobe
- upper pole nodules
- nodules between the trachea and the carotid artery



Case 1096



Case 1370



Some differential diagnostic issues

1. The influence of the normal anatomy of the thyroid

- nonparallel orientation of a lobe
- upper pole nodules
- nodules between the trachea and the carotid artery

2. Influence of pathological conditions

- influence of neighboring nodule or nodules

Horizontal view

Horizontal view



Case 2121



Longitudinal view

Longitudinal view

Some differential diagnostic issues

1. The influence of the normal anatomy of the thyroid
 - nonparallel orientation of a lobe
 - upper pole nodules
 - nodules between the trachea and the carotid artery
2. Influence of pathological conditions
 - influence of neighboring nodule or nodules
 - macrocalcifications

Horizontal view

Horizontal view



Case 110845

Case comp 057



Longitudinal view

Longitudinal view

Some differential diagnostic issues

1. The influence of the normal anatomy of the thyroid
 - nonparallel orientation of a lobe
 - upper pole nodules
 - nodules between the trachea and the carotid artery
2. Influence of pathological conditions
 - influence of neighboring nodule or nodules
 - macrocalcifications
 - thyroiditis



Case 2125



Case 2129



Horizontal view

Horizontal view



Case 2122

Case comp 043



Longitudinal view

Longitudinal view

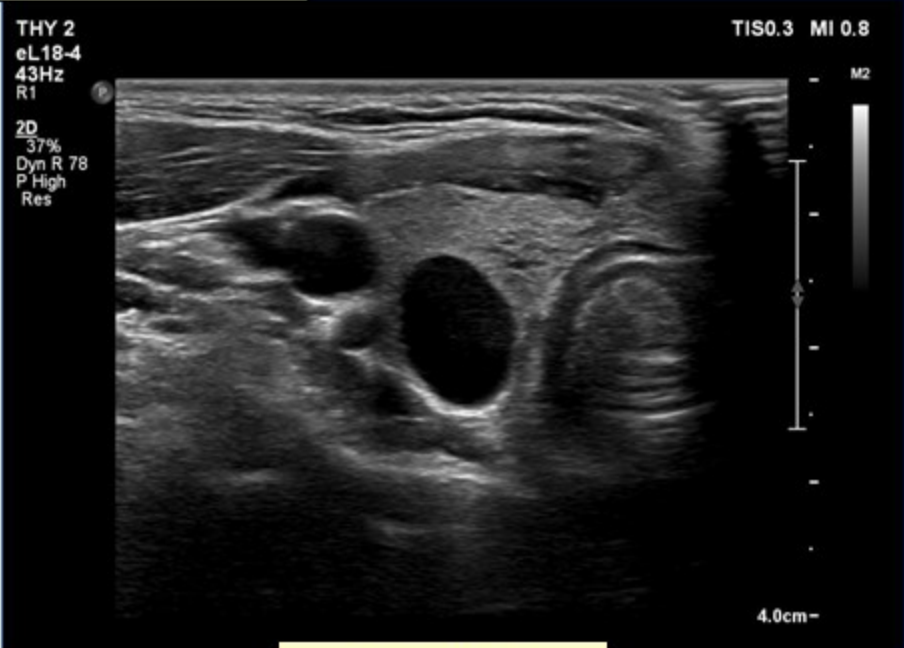
Some differential diagnostic issues

1. The influence of the normal anatomy of the thyroid

- nonparallel orientation of a lobe
- upper pole nodules
- nodules between the trachea and the carotid artery

2. Influence of pathological conditions

- influence of neighboring nodule or nodules
- macrocalcifications
- thyroiditis
- dominantly cystic nodules and nonparallel orientation



Case 2086



Case 956



Some differential diagnostic issues

1. The influence of the normal anatomy of the thyroid
 - nonparallel orientation of a lobe
 - upper pole nodules
 - nodules between the trachea and the carotid artery
2. Influence of pathological conditions
 - influence of neighboring nodule or nodules
 - macrocalcifications
 - thyroiditis
 - dominantly cystic nodules and nonparallel orientation
3. The importance of sticking to the definition



Case 2251

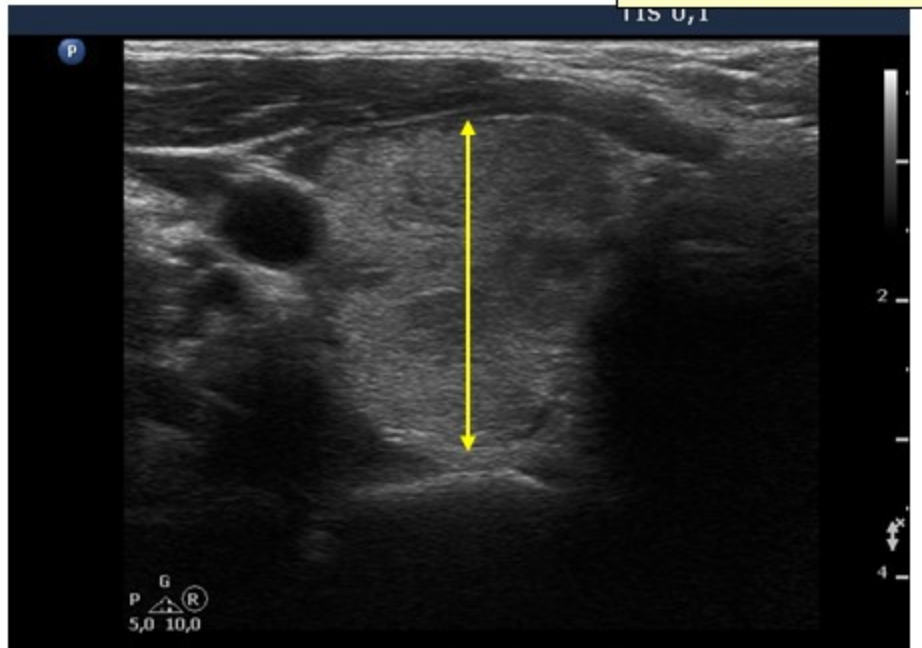


Case 718





Case 2251

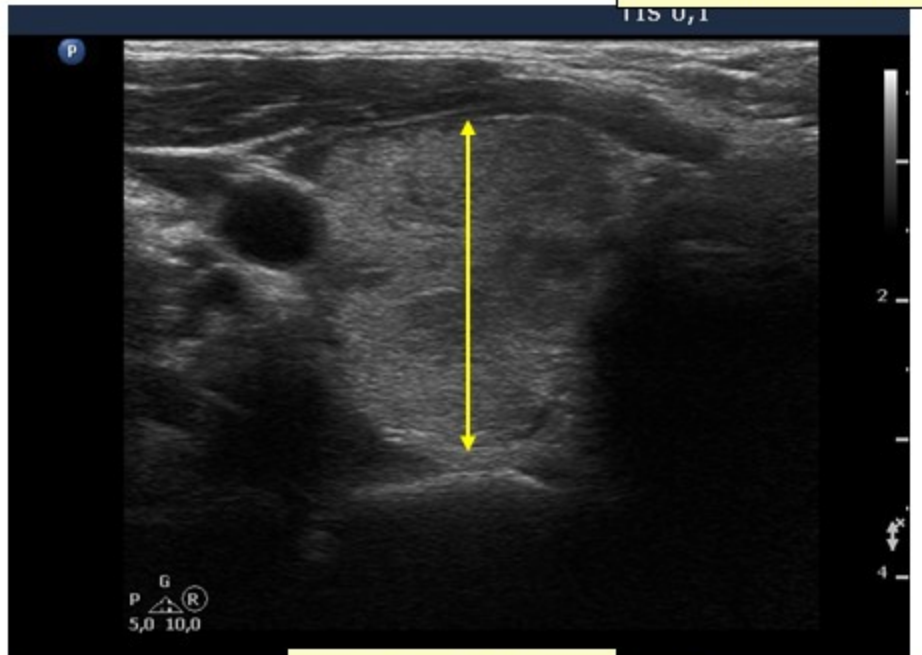


Case 718

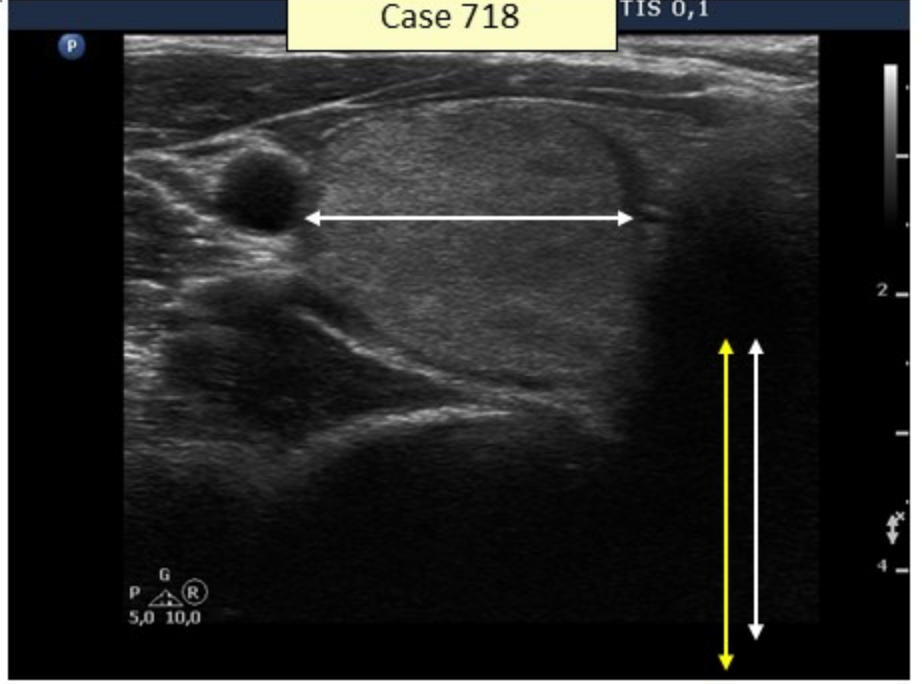




Case 2251



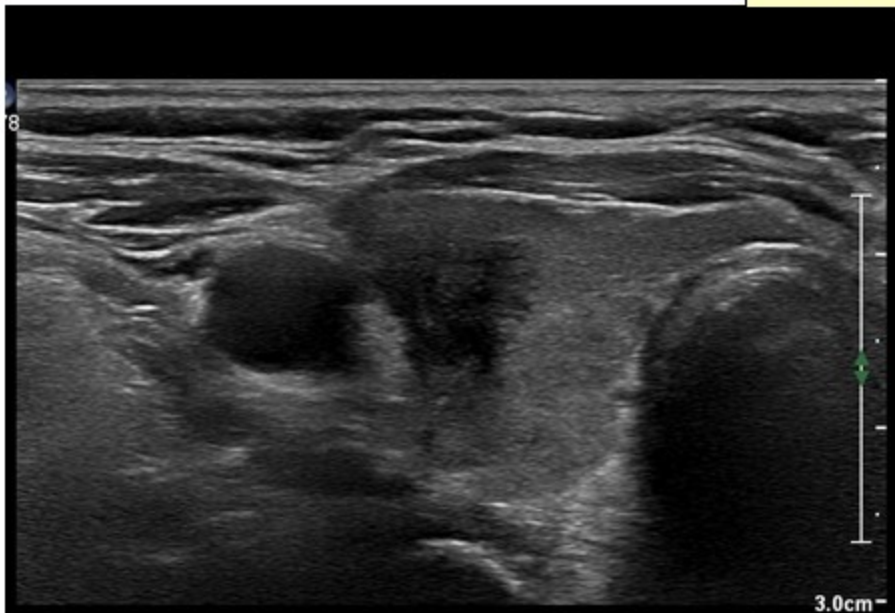
Case 718



Nonparallel orientation - summary

1. Nonparallel orientation (NPO) is the most specific suspicious sign suggesting an increased risk of papillary carcinoma
2. The role of NPO is restricted to papillary cancer.
3. Compared with other suspicious features, NPO is least exposed to interobserver variations.
4. We have to consider that a yes or no answer does not replicate the real-world situation. In the latter the ratio of depth to width correlates with the risk of malignancy.
5. The taller-than-wide sign has much greater diagnostic power than the taller than length sign, however the latter also increases the risk of papillary carcinoma.

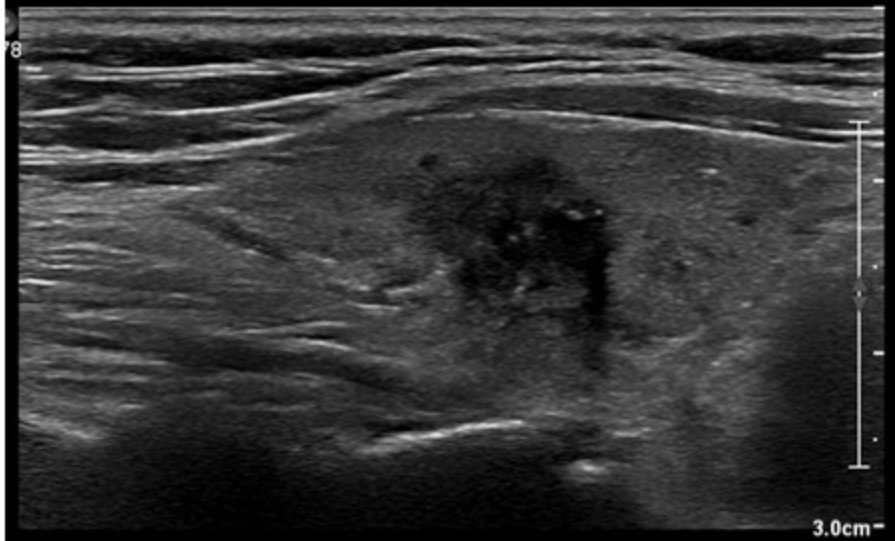
Transverse view



Case 2256



Case 1370



Longitudinal view