The role of ultrasound in the evaluation and management of thyroid nodules

Characteristics of thyroid nodules

T. Solymosi

www.thyrosite.com

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Topics of section ‚Nodular goiter'

Section ‚Nodular goiter'

1. Introductory lecture – the role of ultrasound in the evaluation of nodular goiter
2. Ultrasound features to be analyzed
3. Integration of the US features

Additional chapters in a related ‚Advanced section'

1. The relation between discrete lesions and pathological nodules
2. Difficult to-analyze US patterns and substernal spread
3. The TIRADS

Goal of the evaluation and management

1. Is there a nodule present?
2. Is surgery necessary?
3. If not, is a check required and if yes, how often

Goal of the evaluation and manegement

1. **Is there a nodule present?**
    - US has an exclusive role

2. Is surgery necessary?
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1. Is there a nodule present?
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2. **Is surgery necessary?**
   - clinical evaluation, TSH and US have a major, in up to 95% an exclusive role

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Goal of the evaluation and manegement

1. Is there a nodule present?
   - US has an exclusive role

2. Is surgery necessary?
   - clinical evaluation, TSH, US and FNA have a major, in up to 95% an exclusive role

3. If not, **is a check required** and if yes, **how often?**
   - US has a crucial role

Diagnosing a nodule

1. Most neglected field in thyroidology
2. In which sense do we use the term ’nodule’?
3. The relation between discrete echo abnormality and pathological nodule
    - 95% of Hashimoto’s patients present with discrete lesions

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Some considerations

- Use the term nodule in pathological sense and not for discrete lesions of thyroiditis
- Restrict the term nodule for
    - lesions ≥ 10 mm
    - suspicious nodules ≥ 5 mm

Transverse view

Longitudinal view

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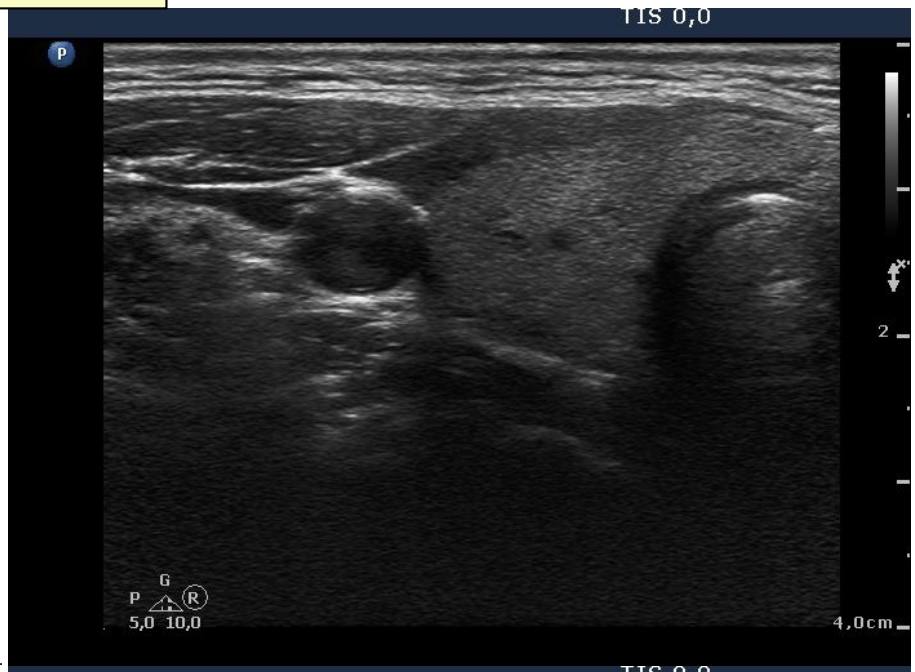
Transverse view



Longitudinal view

The role of ultrasound in indication of surgery

1. Autonomously functioning adenoma causing hyperthyroidism
2. Goiter causing compression symptoms
3. Suspicion of malignancy

The role of ultrasound in indication of surgery

1. Autonomously functioning thyroid nodule (AFTN) causing hyperthyroidism
   - measuring the size of the nodule
   - examination of the whole thyroid – surgery vs. radioiodine therapy

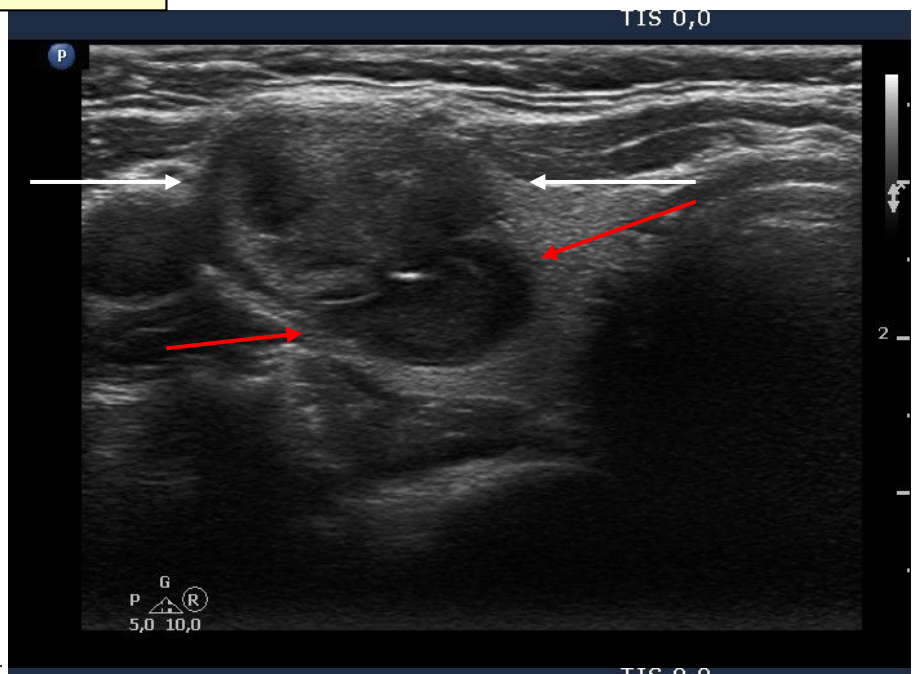
Right lobe

Left lobe

Right lobe

Left lobe

Right lobe



Left lobe

The role of ultrasound in indication of surgery

1. Autonomously functioning thyroid nodule (AFTN) causing hyperthyroidism
   - measuring the size of the nodule
   - examination of the whole thyroid – surgery vs. radioiodine therapy
2. Goiter causing compression symptoms
   - the **size of the lobe** and not the size of the nodule(s) is decisive
   - the position of the thyroid
   - substernal spread
   - nodule in the isthmus

Transverse view

Size of the nodule (width, depth, length)

22 x 13 x 53 mm = 7.93 ml

Size of the lobe (width, depth, length)

27 x 15 x 57 mm = 12.1 mL

Case cons100_073

Longitudinal view

Longitudinal view

Transverse view

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22 x 13 x 53 mm = 7.93 ml

Size of the lobe (width, depth, length)

27 x 15 x 57 mm = 12.1 mL

Normal upper limit of a lobe:

9 mL in women and 12.5 mL in men

Case cons100_073

Longitudinal view

Longitudinal view

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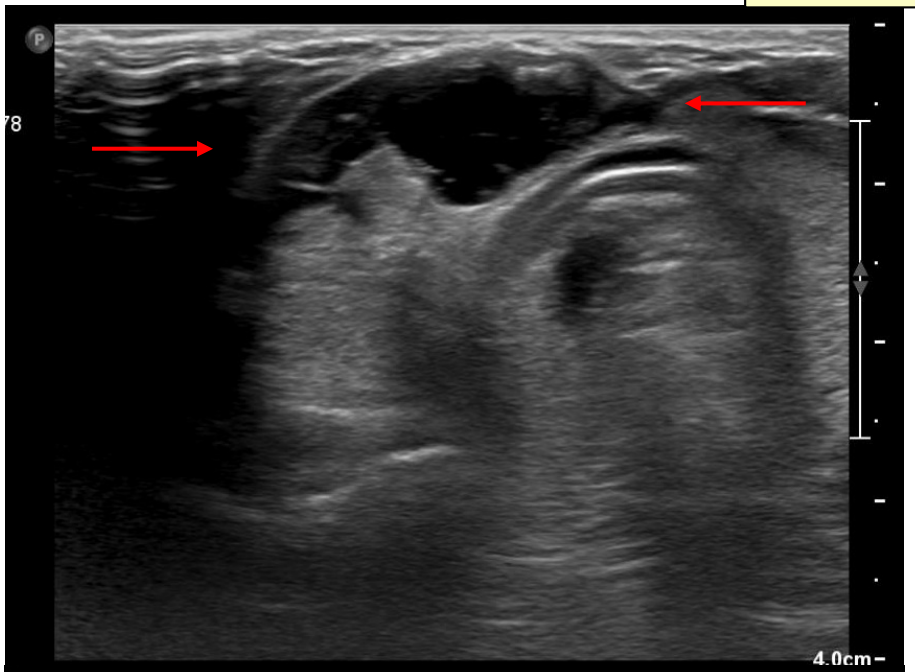

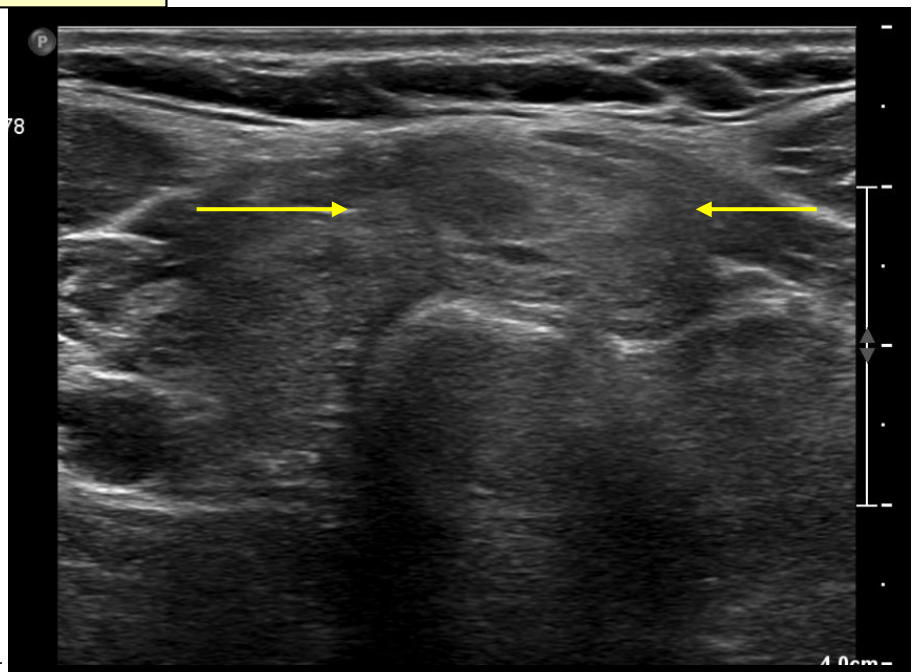

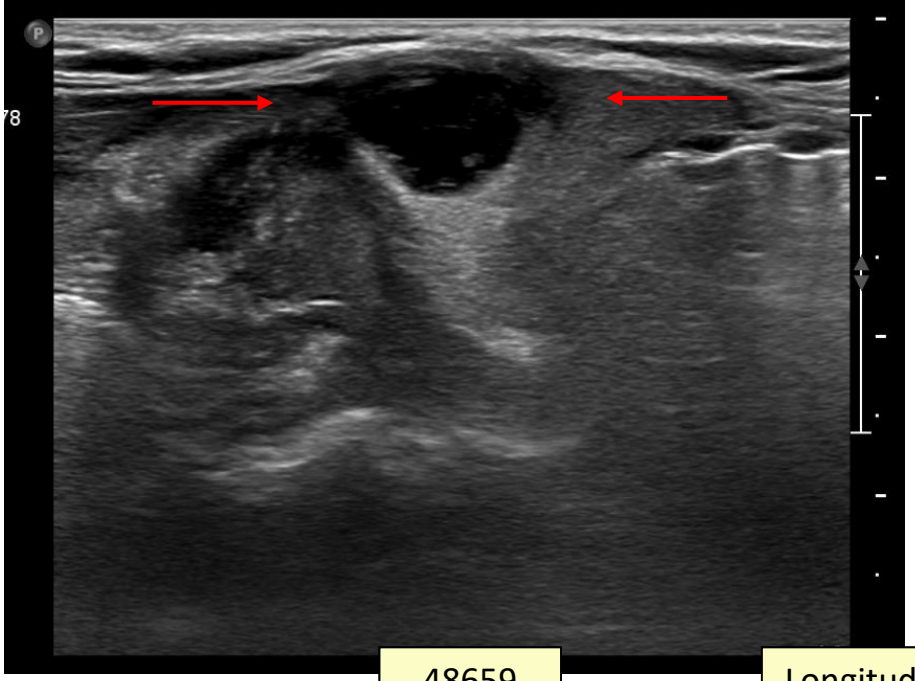

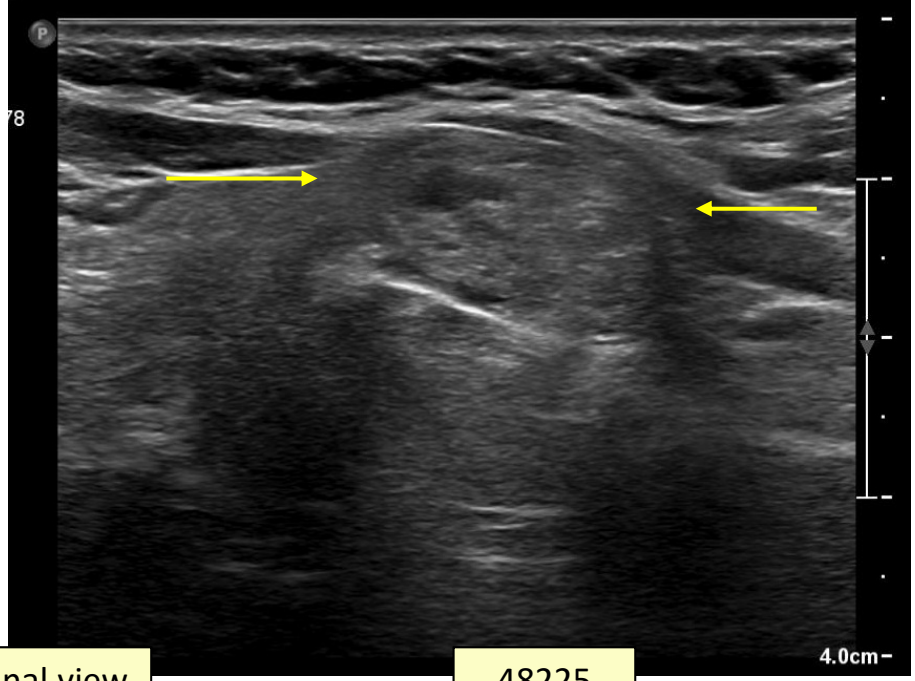

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Longitudinal view

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   A very close cooperation is required between the endocrinologist and the radiologist, if not the former performs US.

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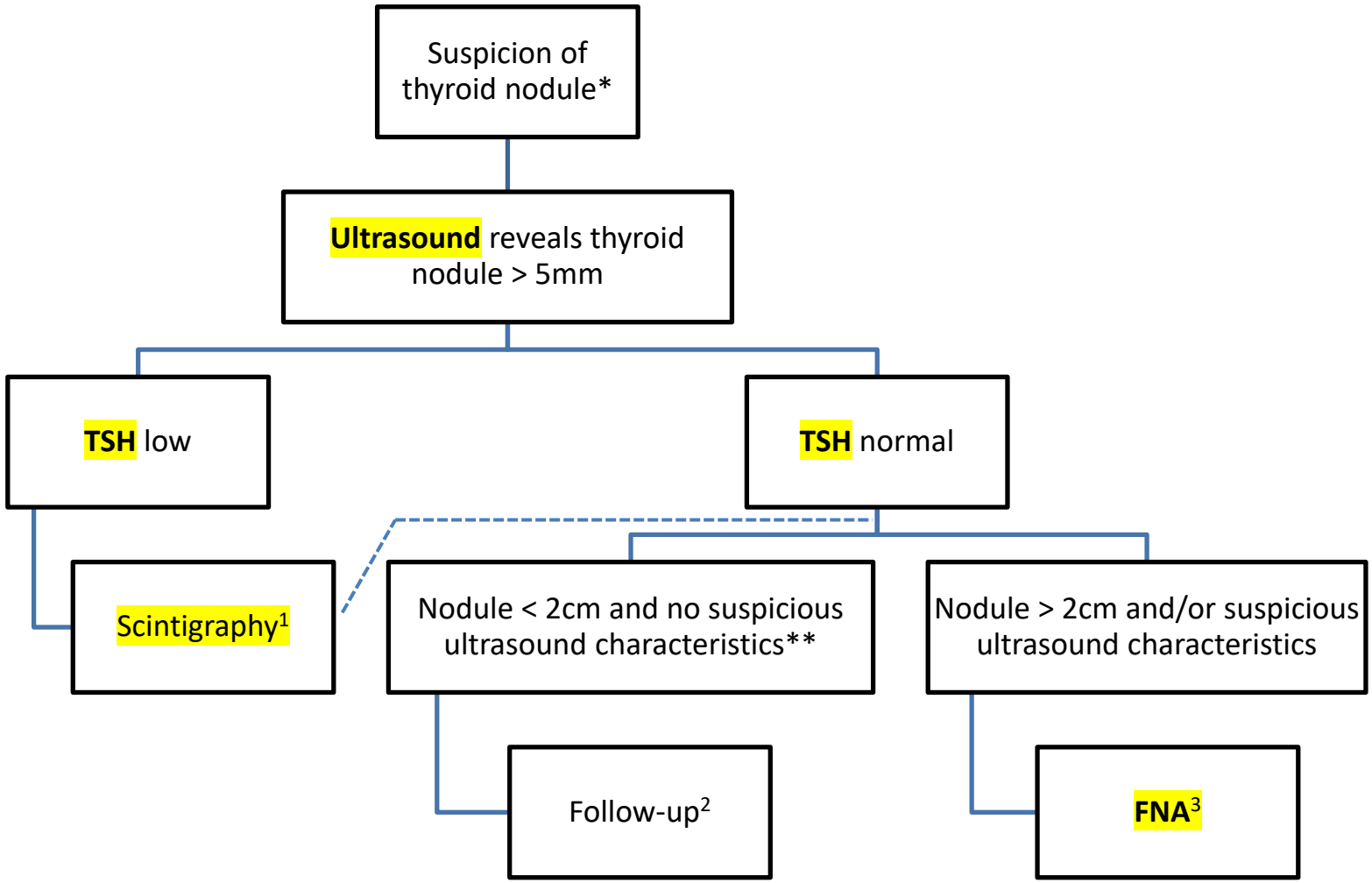
3. Suspicion of malignancy

Evaluation of thyroid nodules (after 2006)



Issue 1 – ‚Suspicion of nodule'

1. Justified
   - palpation
   - nodule found on other **justified** radiologic examinations
2. Non-justified
   - ultrasound screening
   - carotid Doppler examination

Issue 1 – ‚Suspicion of nodule'

1. Ultrasound screening for thyroid cancer
   - „**The net benefit of screening for thyroid cancer is negative**."
     (US Preventive Services Task Force, JAMA 2017)
   - This is a business and not a medical activity
2. Negative consequences of US screening
   - for the screened population
     - overdiagnosis and overtreatment
   - for the thyroid patient' population
     - resource deprivation
     - delay in diagnosis and therapy

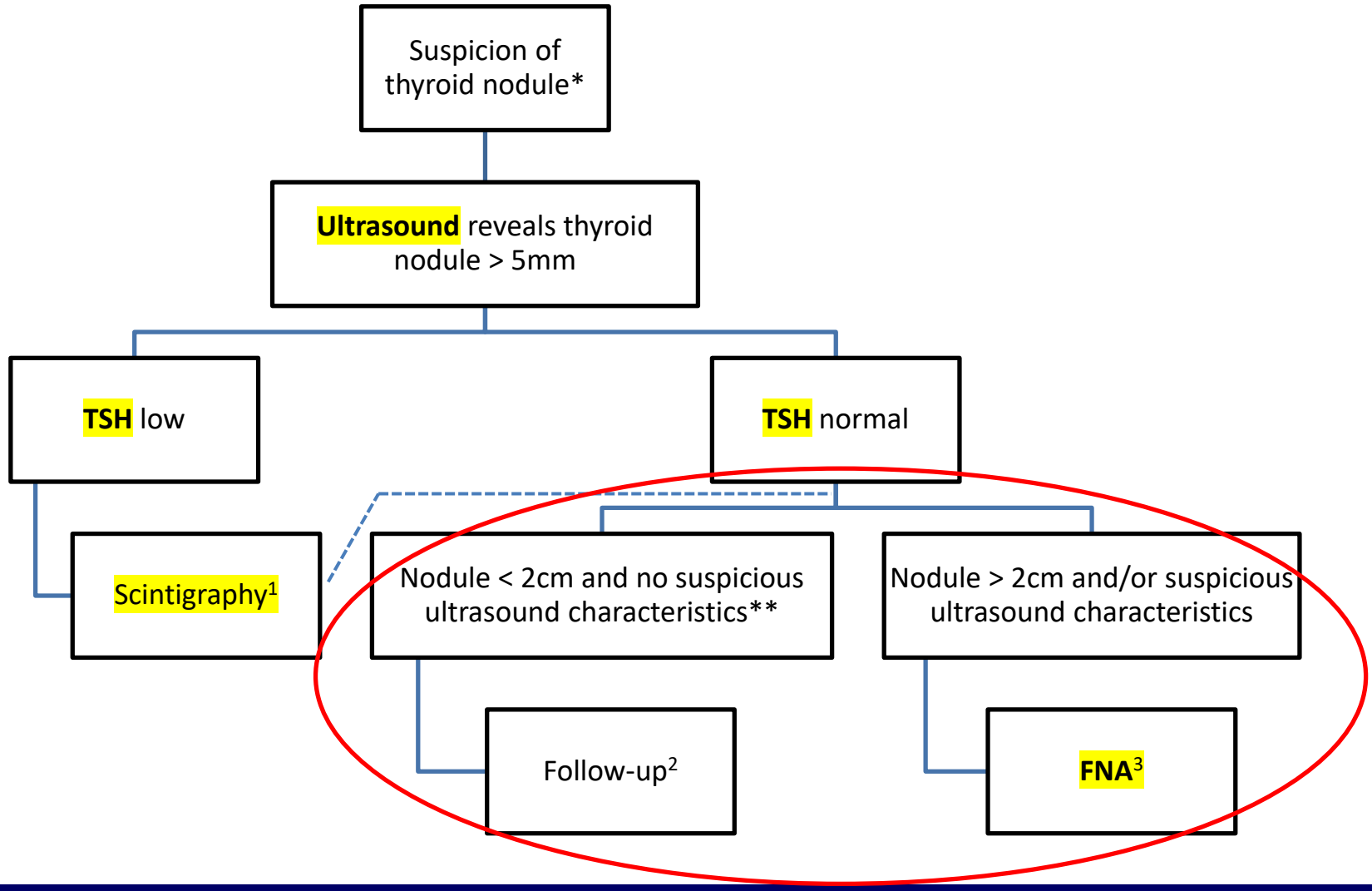
Issue 2 – definition of thyroid nodule

1. Almost every adult person has discrete lesion on ultrasound.
2. Which one is the most frequent US finding in Hashimoto's thyroiditis?
   - not hypoechogenicity but discrete lesion
3. The relation between discrete lesion and pathological nodule
   - completely neglected in thyroid literature

Suggestions

1. Lesions < 5 mm
   - not to use the term ‚nodule'
2. Lesions 5-10 mm
   - not to use the term ‚nodule' if suspicious characteristics are lacking

Evaluation of thyroid nodules (after 2006)

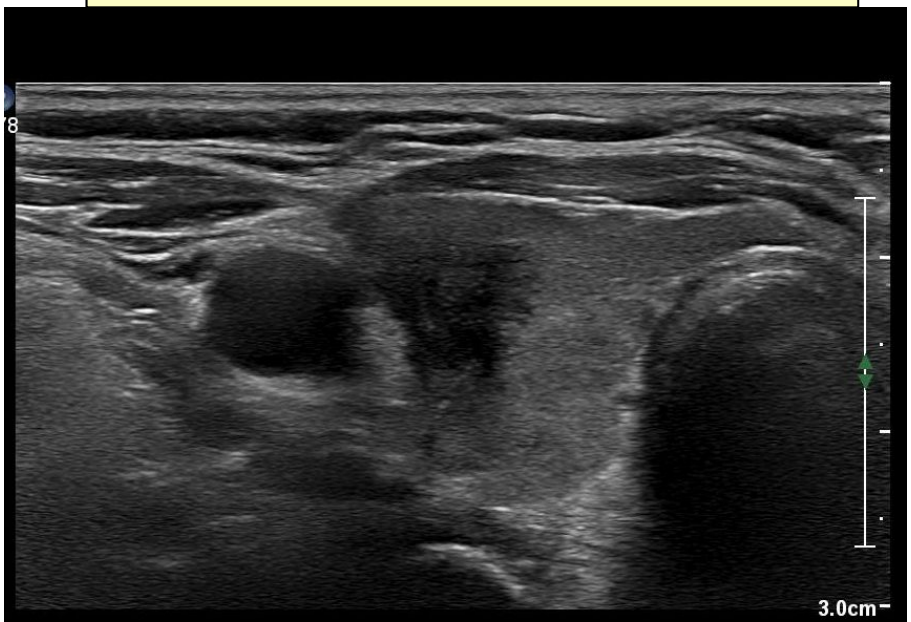


Issue 3 – suspicious characteristics

	AACE	ACR	ATA	ETA	Korean
Deep hypoechogenicity	Y	Y	No	Y	No
Microcalcification	Y	Y	Y	Y	Y
Nonparallel orintation	Y	Y	Y	Y	Y
Irregular borders	Y	Y	Y	Y	Y
Extrathyroidal growth	Y	No	Y	No	Y
Rim calcification	No	Y	Y	No	No

Deep hypoechogenicity

Nonparallel orientation and irregular borders



Microcalcification

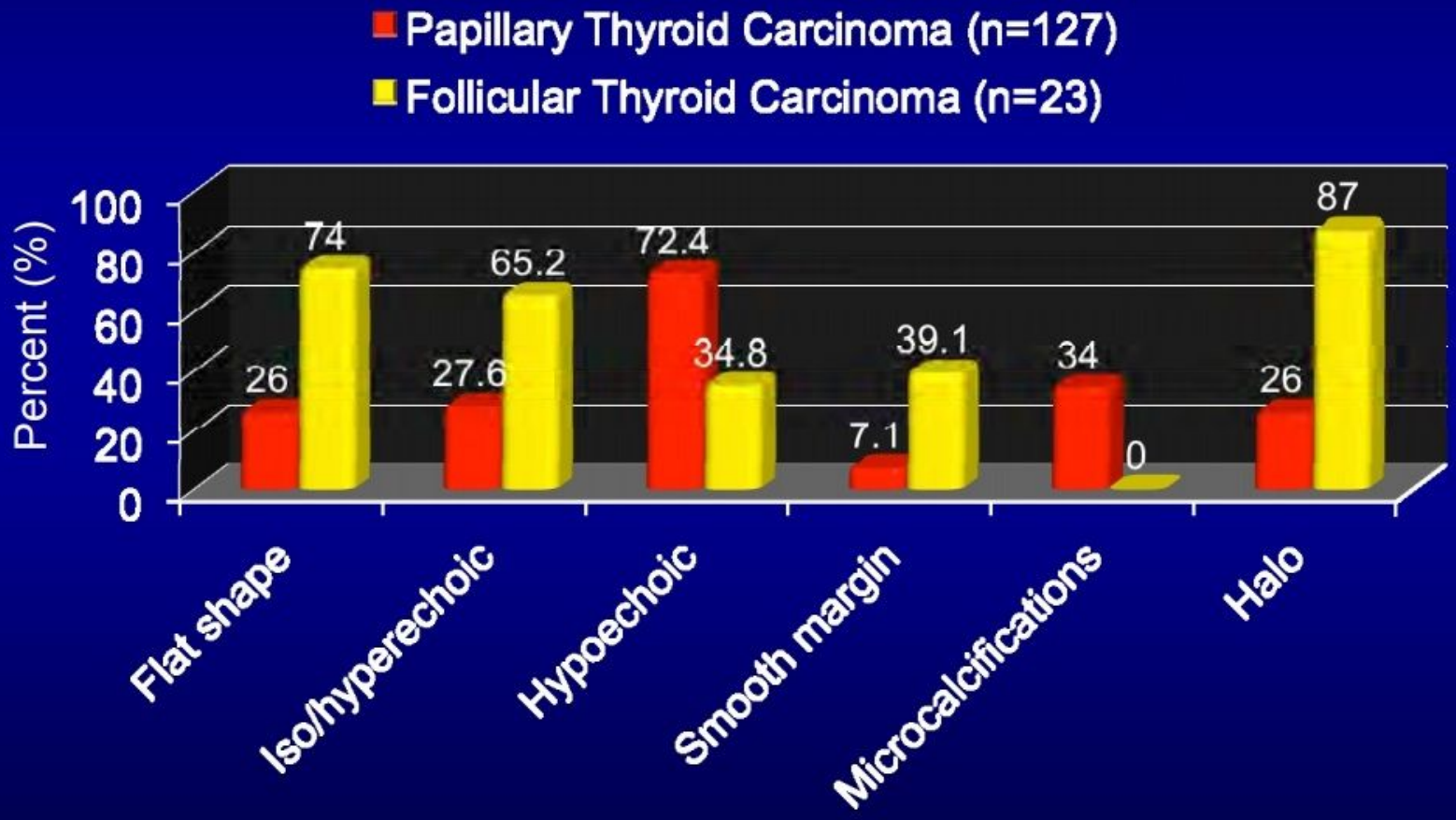
Extrathyroidal growth

Issue 3 – suspicious characteristics

1. 80-95% of all thyroid cancers are papillary cancers.
2. The features of papillary cancer determine what we think is a suspicious sign of all thyroid cancer.

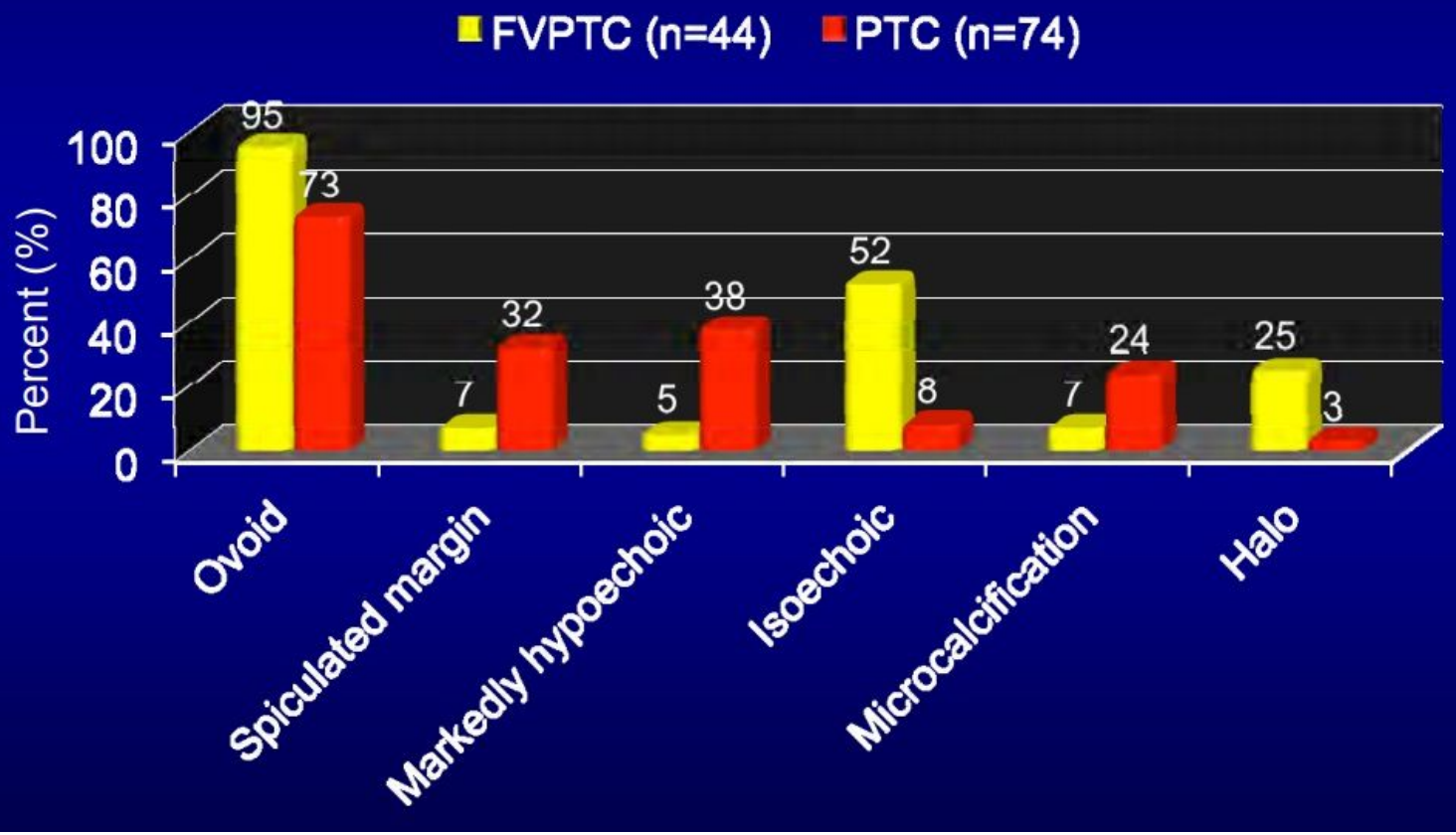
The significance of the echogenicity of a nodule (*Jeh-2007*)

Papillary vs Follicular Thyroid Cancers



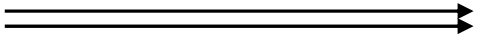
The significance of the echogenicity of a nodule (*Kim-2009*)

Sonographic features
FVPTC vs Conventional PTC



Issue 3 – suspicious characteristics

1. 80-95% of all thyroid cancers are papillary cancers.
2. The features of papillary cancer determine what we think is a suspicious sign.
3. For all suspicious signs, follicular cancer behaves completely the opposite



If we rely on suspicious characteristics (of PTC) to indicate FNA, significant proportion of follicular cancers remains undiagnosed or will be diagnosed with delay.

Issue 3 – suspicious characteristics

Two quotes from the conclusions of a metaanalysis (*Trimboli-2020*):

„During our clinical practice we are on the hunt of PTCs while we are neglecting the most aggressive thyroid cancers”

„An important diagnostic effort **should** be fielded to allow clinicians not to miss these diagnoses.”

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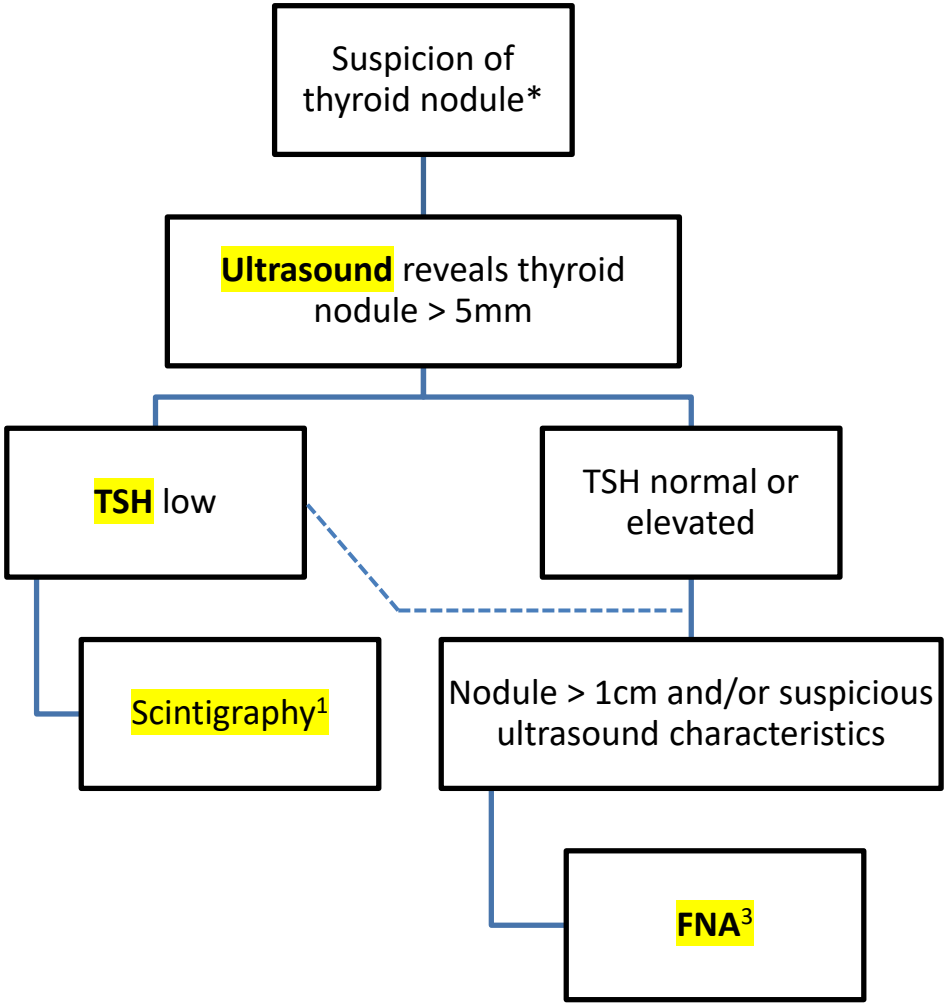
Can we rely on the suggestions of the guidelines?

Should we neglect the suggestions of them on FNA?

Evaluation of thyroid nodules (AACE-2006)



Comparison of the two approaches in nodules between 1-2 cm

	After 2006	AACE-2006
Indication of FNA	Only if US is suspicious	In all nodules
FNA in PTC	85%	100%
FNA in FTC	50%	100%
FNA in benign nodules	60%	100%

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Comparison of the two approaches in nodules between 1-2 cm

	After 2006	AACE-2006
Indication of FNA	Only if US is suspicious	In all nodules
FNA in PTC (N=90)	77 (85%)	90 (100%)
FNA in FTC (N=10)	5 (50%)	10 (100%)
FNA in benign nodules (N=900)	540 (60%)	900 (100%)

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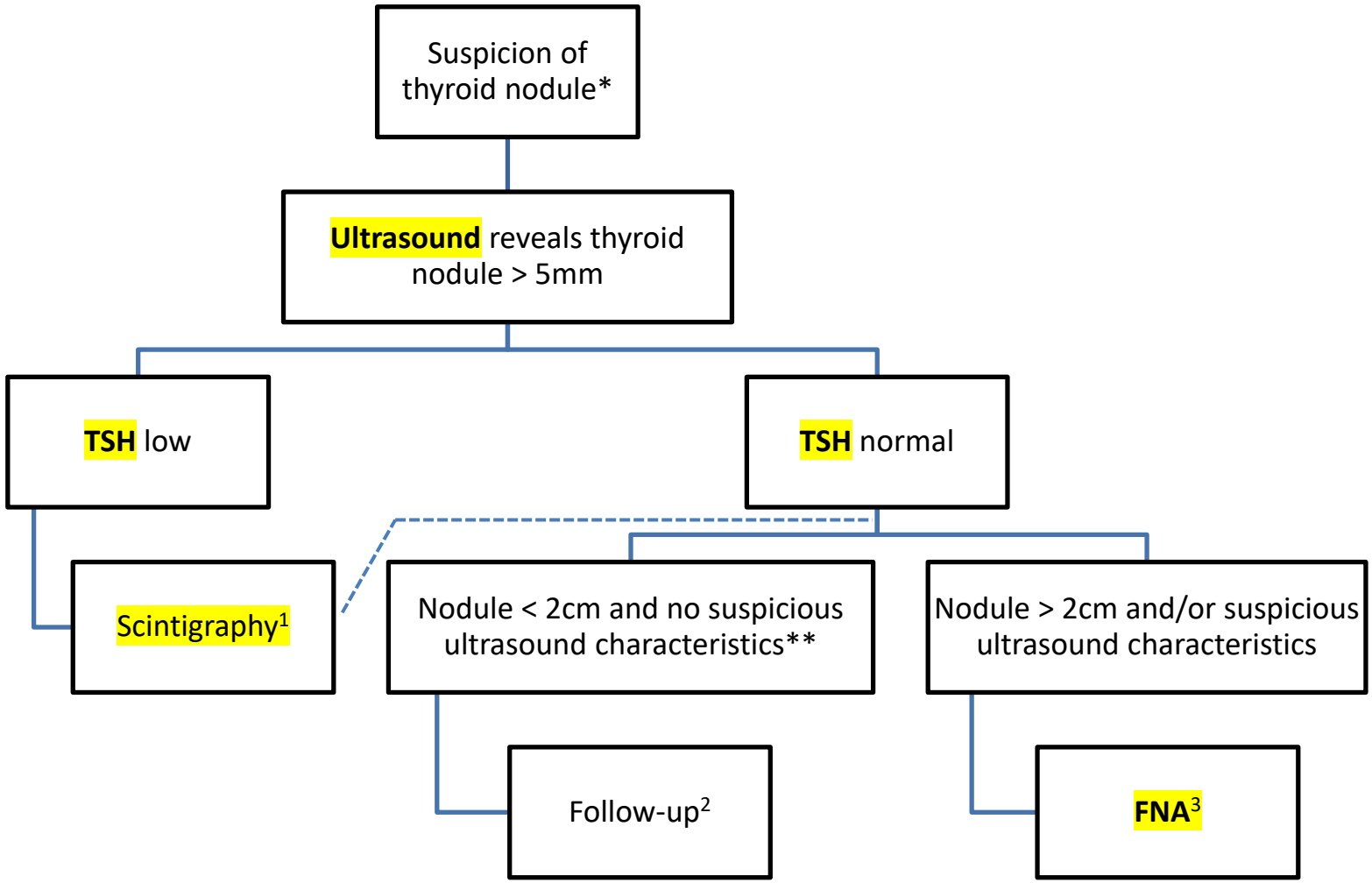

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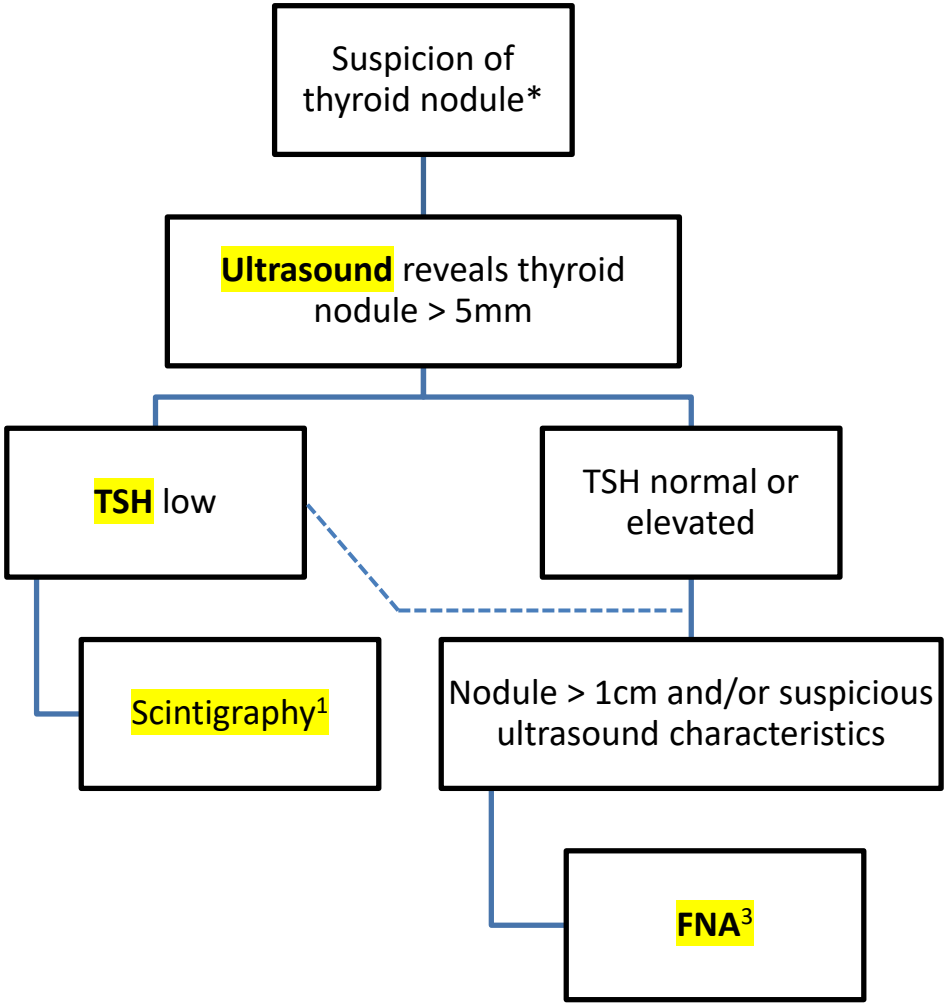

The role of ultrasound in indication of surgery

Ultrasound-guided aspiration

When not US-guided

- in homogeneous, well-palpable nodules

The role of ultrasound after completion of patient' evaluation

1. The issue of subcentimeter papillary cancers
   - Is there a risk of multifocality?
   - Is there a risk of extrathyroidal growth?
2. The issue of the refusal of FNA and non-diagnostic FNA
   - The indication for surgery depends largely on ultrasound presentation
3. The role of US in benign cytology
   - US pattern very suspicious for cancer
4. The possible role of US in cytologically diagnosed follicular tumors

The role of ultrasound in the follow-up of patients

Objectives of the follow-up

Similar to the goals of the first evaluation: to operate or not to operate

1. TSH-test – exclusion of a hyperthyroidisim
2. Recognition of significant growth of the nodular lobe
3. Recognition of false negative FNA

The role of ultrasound in the follow-up of patients

Objectives of the follow-up and the role of ultrasound

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The role of ultrasound in the follow-up of patients

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2. Recognition of significant growth of the nodular lobe

The basis of the follow-up is the volume of the nodule and the thyroid.

- If the initial values are lacking, there's nothing to compare
- Take the variations in measurement into account
  - intraobserver variation is around 30%
  - interobserver variation is around 50%

First check in 1 year, thereafter every 3 to 5 years.

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   First check in 1 year, thereafter every 3 to 5 years.
3. Recognition of false negative FNA

   Based on either US characteristics or growth of the nodule

   The importance of archiving the videos recorded at the examination

   Repeat cytology

   - routine repetition is not recommended
   - once if the lesion shows suspicious findings
   - consider in benign-appearing nodule if its growth > 30% in volume

Summary

The ultrasound has crucial role in the evaluation of thyroid nodules

- an almost exclusive role is diagnosing a nodule
- the most important role in deciding on surgery
- basic role in the follow-up of non-operated patients

Some take-home messages

- US screening is not a medical activity
- The importance of measuring the three diameters of the lobes
- US presentation of papillary and follicular cancers is just the opposite
- A thought about our responsibility