

Schilddrüsenknoten

Herne 29.11.2023



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Endokrinologie /// Diabetologie /// Osteologie /// Innere Medizin

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www.endo-bochum.de

www.osteoporose-bochum.de

Interessenkonflikte / Disclosures

Vortragshonorare

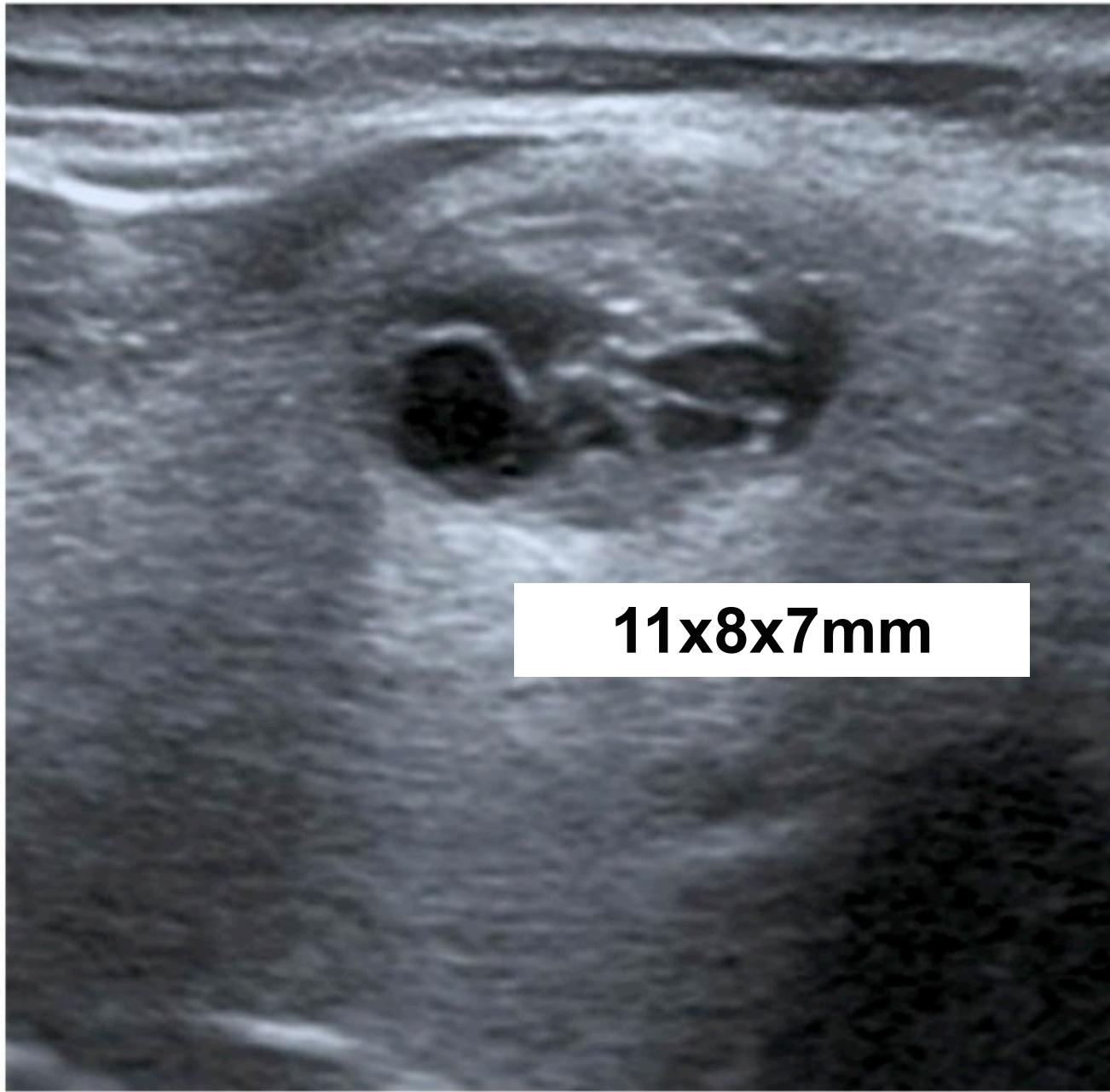
- Amgen
- Boehringer-Ingelheim
- Diagnosticum Labor Dresden
- Novo Nordisk
- Sanofi

Indikation einer SD-Sonographie

- Symptome
- Funktionsstörung

(nicht als Screening)

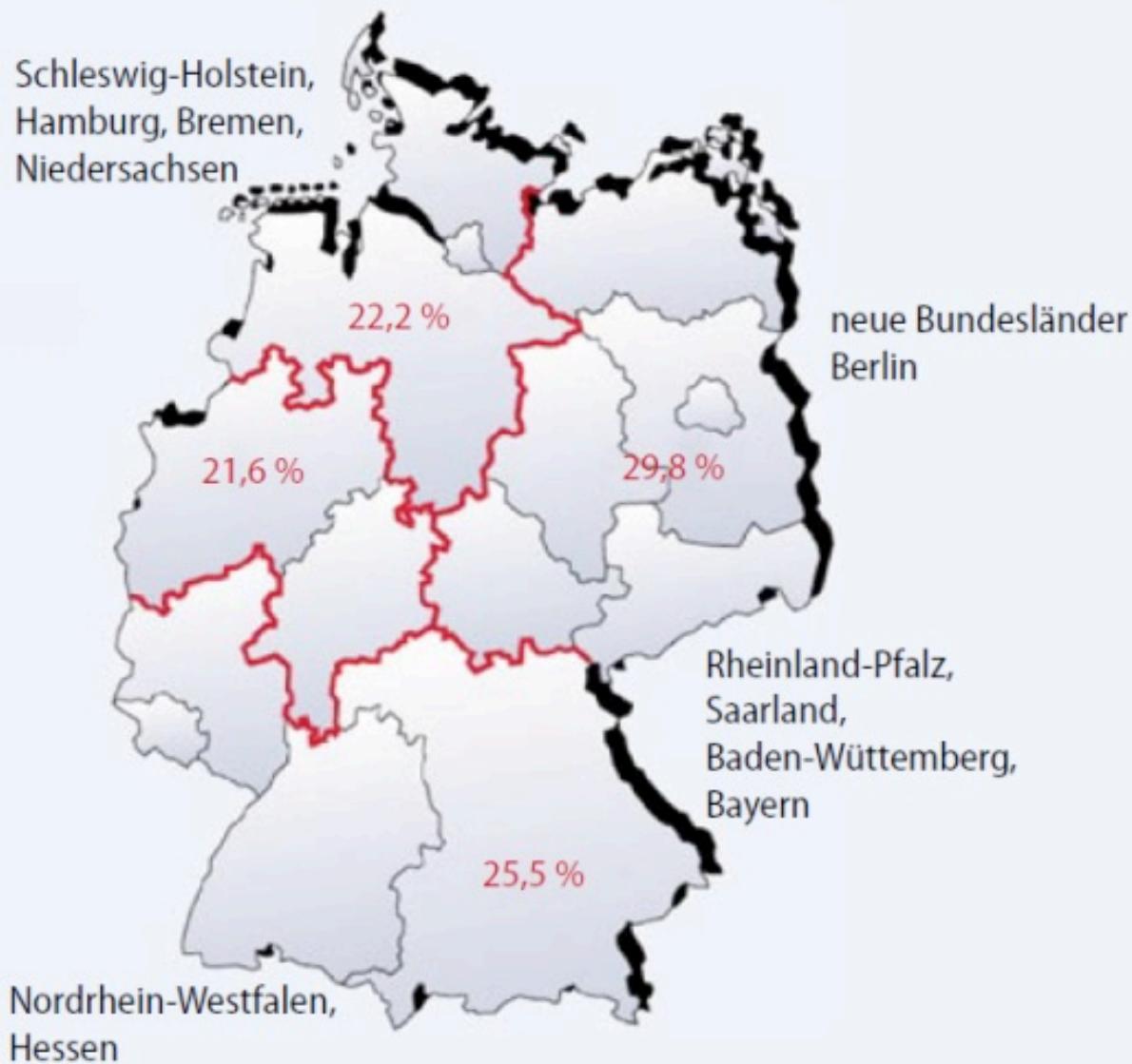




11x8x7mm

Knoten insgesamt
(mit oder ohne Struma)

Bundesdurchschnitt: 24,0 %

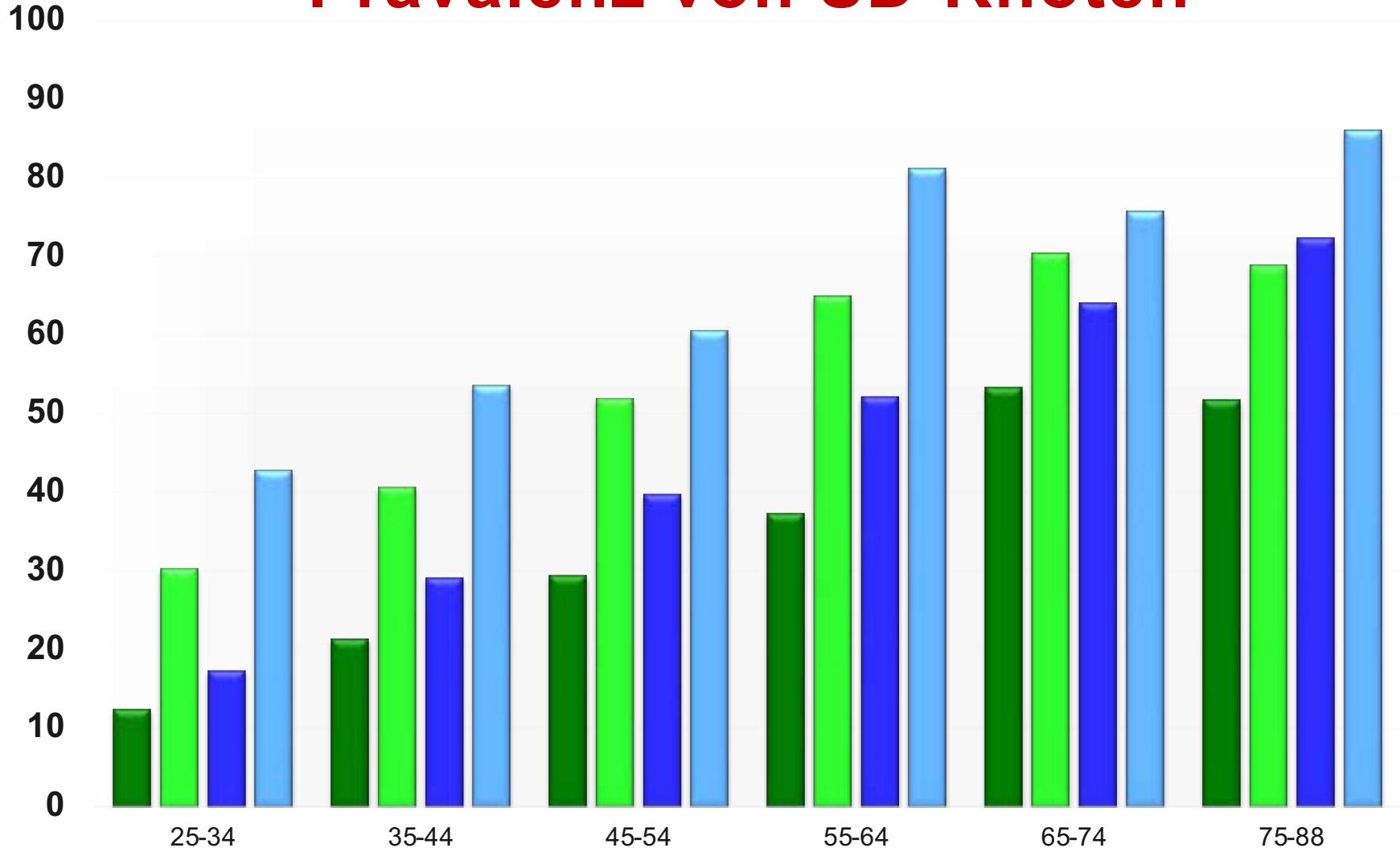


Papillon-Studie

Präv Gesundheitsf 2007 · 2:153–158
DOI 10.1007/s11553-007-0077-x
Online publiziert: 27. Juni 2007

Schumm-Draeger et Feldkamp 2007

Prävalenz von SD-Knoten



SHIP-1 (M F)

2002-2006

n=2505

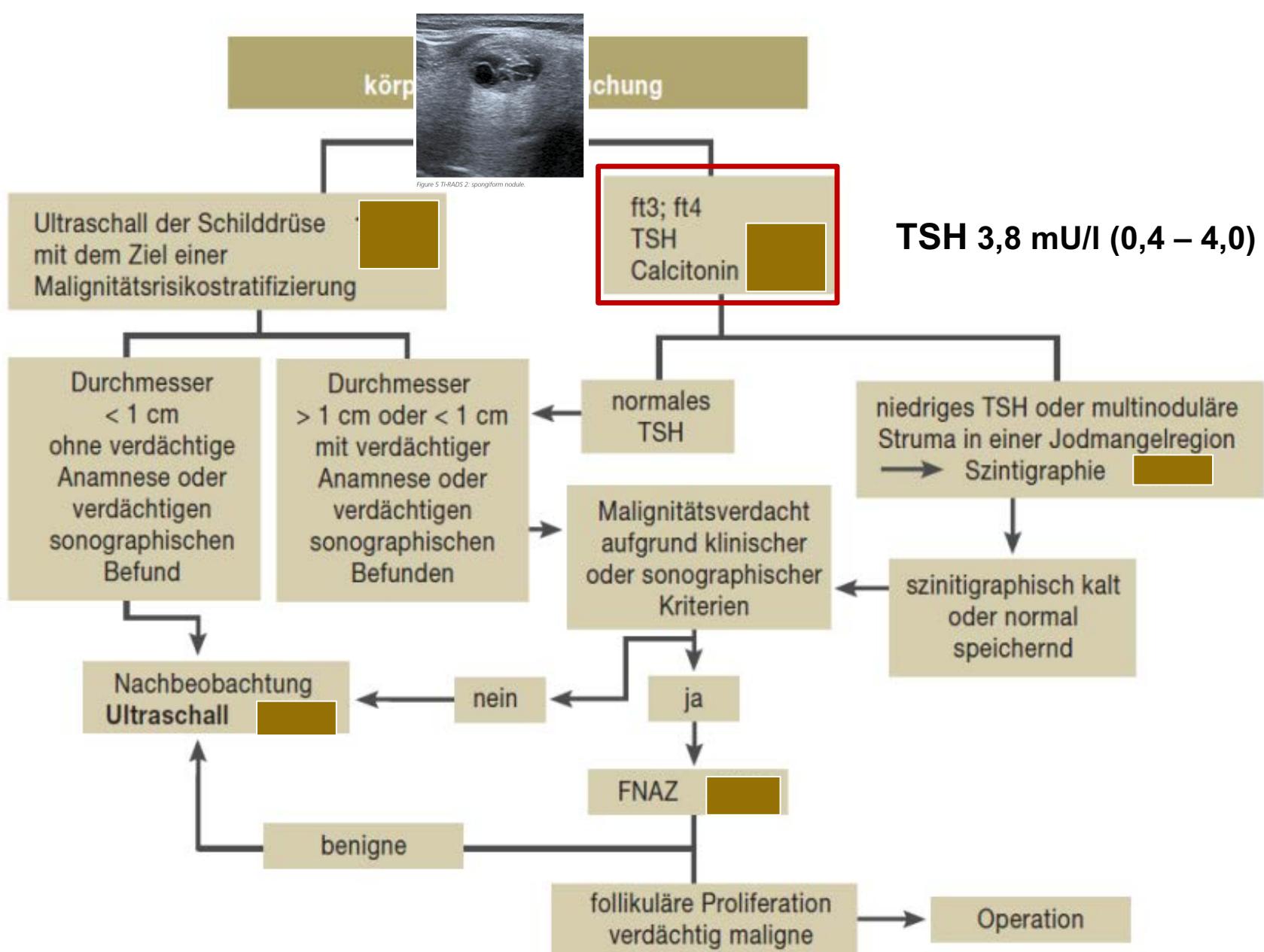
Mecklenburg Vorpommern

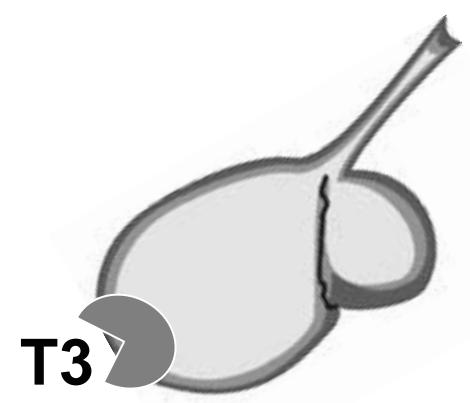
KORA-F4 (M F)

2006-2008

n= 2326

Region Augsburg





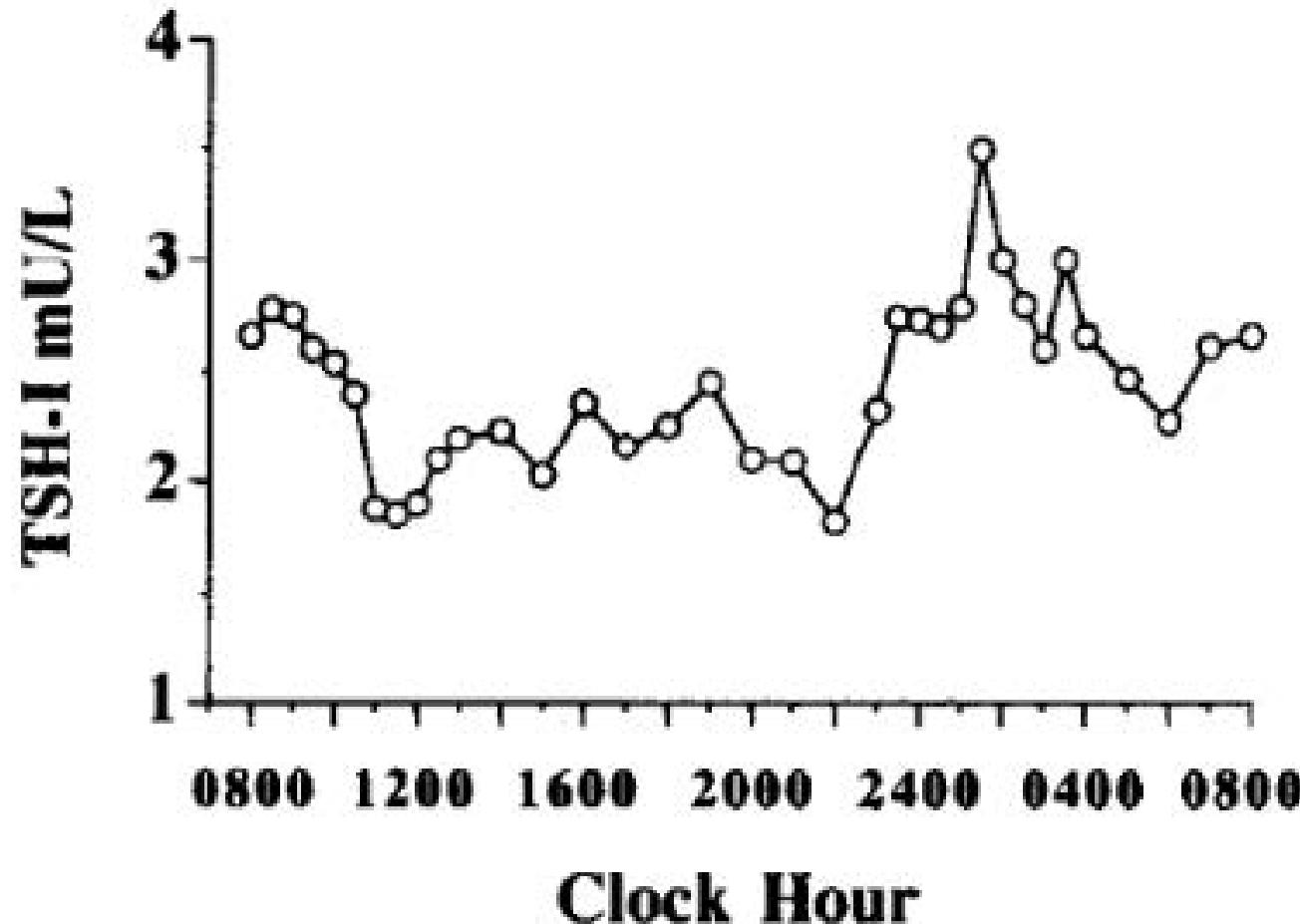
TSH



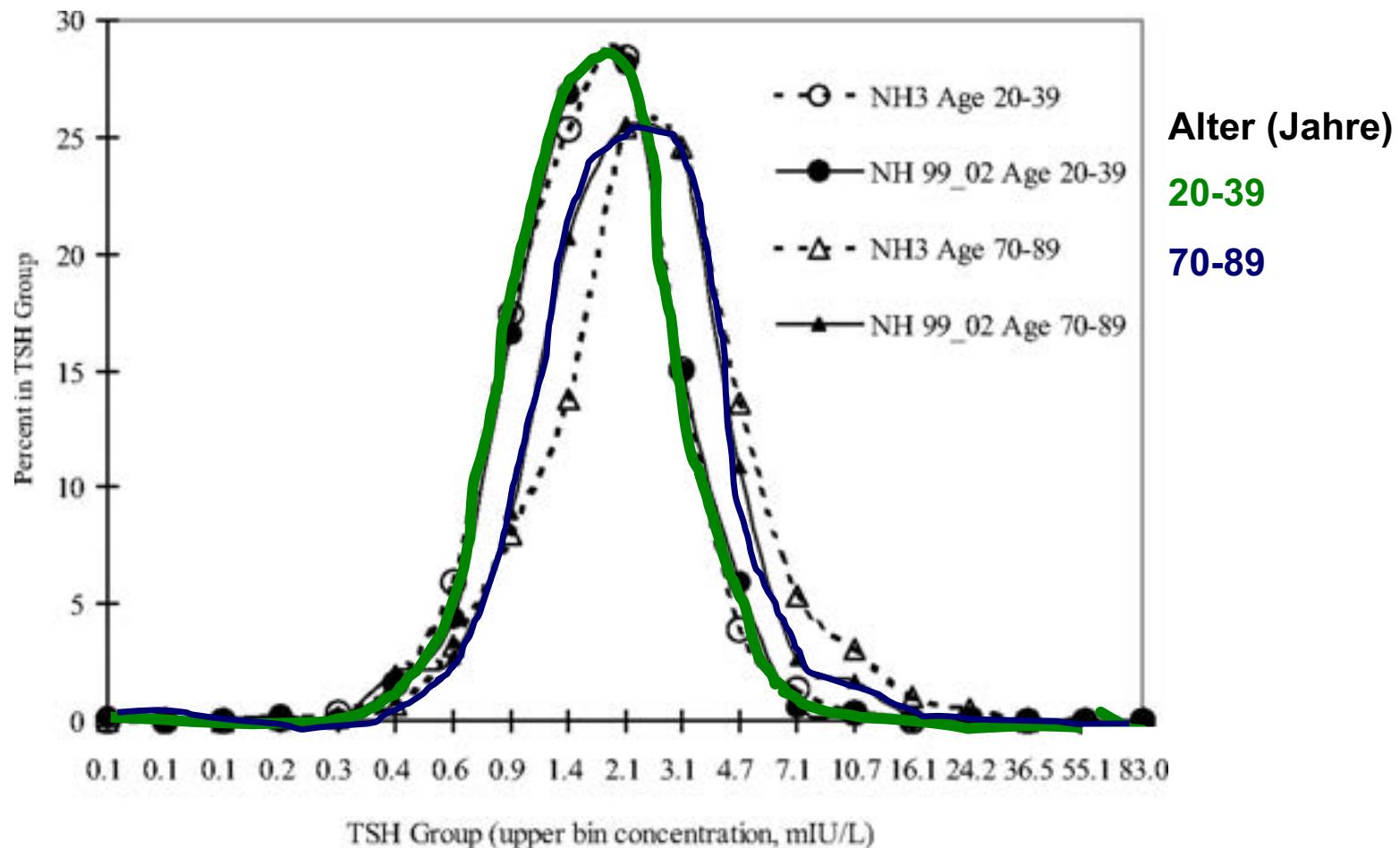
T4

T3

Circadian Variations of Thyrotropin (TSH) Bioactivity in Normal Subjects



TSH: Alters-spezifische Unterschiede



Shift in TSH distribution to higher concentrations with age. Data from NHANES III (NH3) and NHANES 1999–2002 (NH 99_02) populations

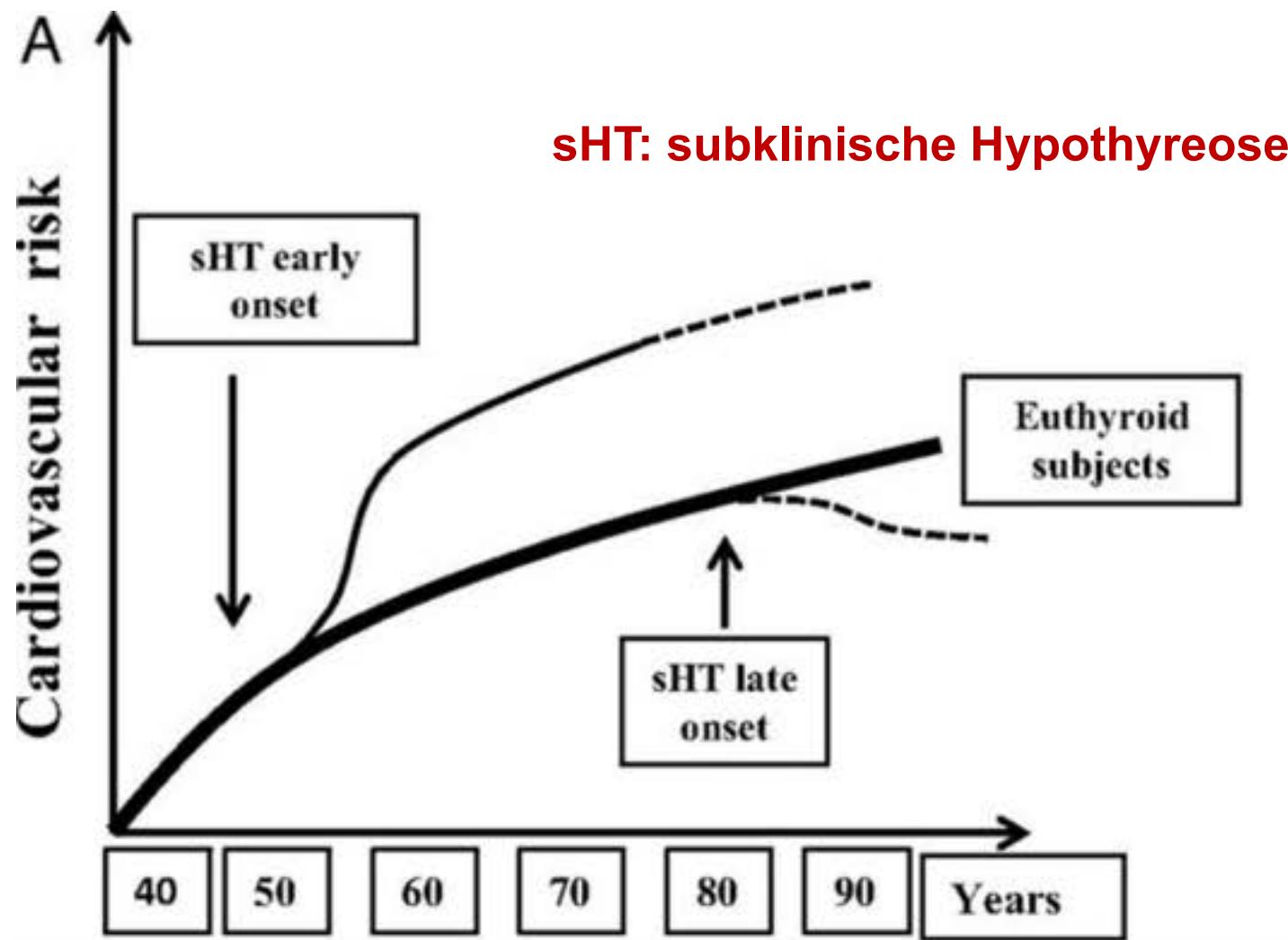
TSH und kardiovaskuläres Risiko

Table 2. Associations Between Subclinical Hypothyroidism and Clinical Outcome, and Consequences of Treatment.*

Outcome of Subclinical Hypothyroidism	Strength of the Association		Benefits of Treatment
	Thyrotropin 4.5–9.9 mIU/liter	Thyrotropin ≥10 mIU/liter	
Progression to overt hypothyroidism	Strong	Stronger	Early treatment before development of overt hypothyroidism with more severe symptoms
Symptoms of hypothyroidism (e.g., tiredness, decreased cognition)	Strong	Stronger	Inconsistent, with large trial involving persons with mildly elevated thyrotropin levels (<10 mIU/liter) and very few symptoms showing no effects, and small trials involving persons with thyrotropin levels >10 mIU/liter showing benefits
Surrogate markers of cardiovascular risk (e.g., elevation in total cholesterol and LDL cholesterol levels, increased carotid-wall intima-media thickness, and decreased cardiac function)	Strong	Stronger	Moderate for reduction in total cholesterol and LDL cholesterol levels but unclear whether this is accompanied by a decreased risk of cardiovascular events
Risk of coronary heart disease	Weak	Stronger	Insufficient data to inform benefits
Risk of congestive heart failure	Weak	Stronger	Insufficient data to inform benefits
Risk of stroke	Weak	Weak	Insufficient data to inform benefits
Cognitive decline	Weak	Weak	Insufficient data to inform benefits

* This table is adapted and updated from Surks et al.³ LDL denotes low-density lipoprotein.

Höhere TSH-Werte (4-6 mU/L im Alter)

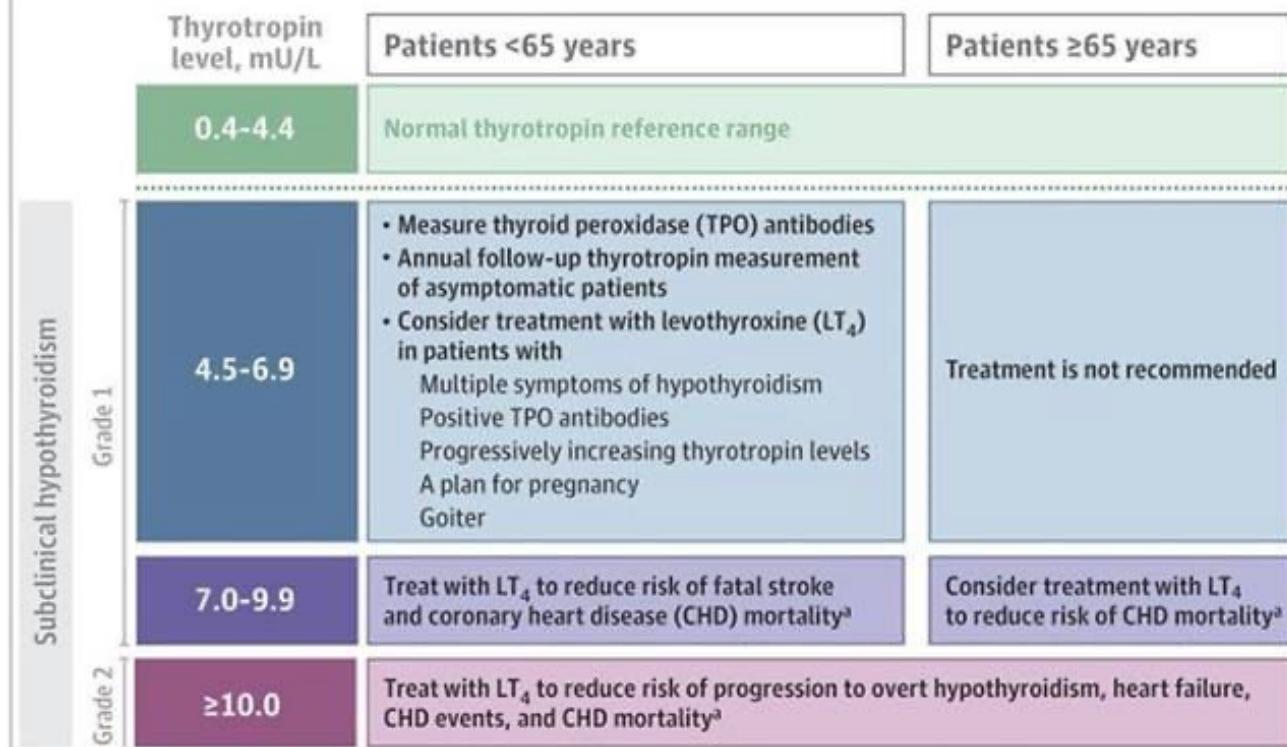


① Diagnosis of an elevated serum thyrotropin (TSH) level in a nonpregnant adult

② Confirmation of persistent subclinical hypothyroidism

- Initial thyrotropin level 4.5-14.9 mU/L, repeat measurement and document normal free thyroxine level in 1-3 months.
- Initial thyrotropin level ≥ 15 mU/L, repeat measurement and document normal free thyroxine level in 1-2 weeks.

③ Treatment initiation considerations



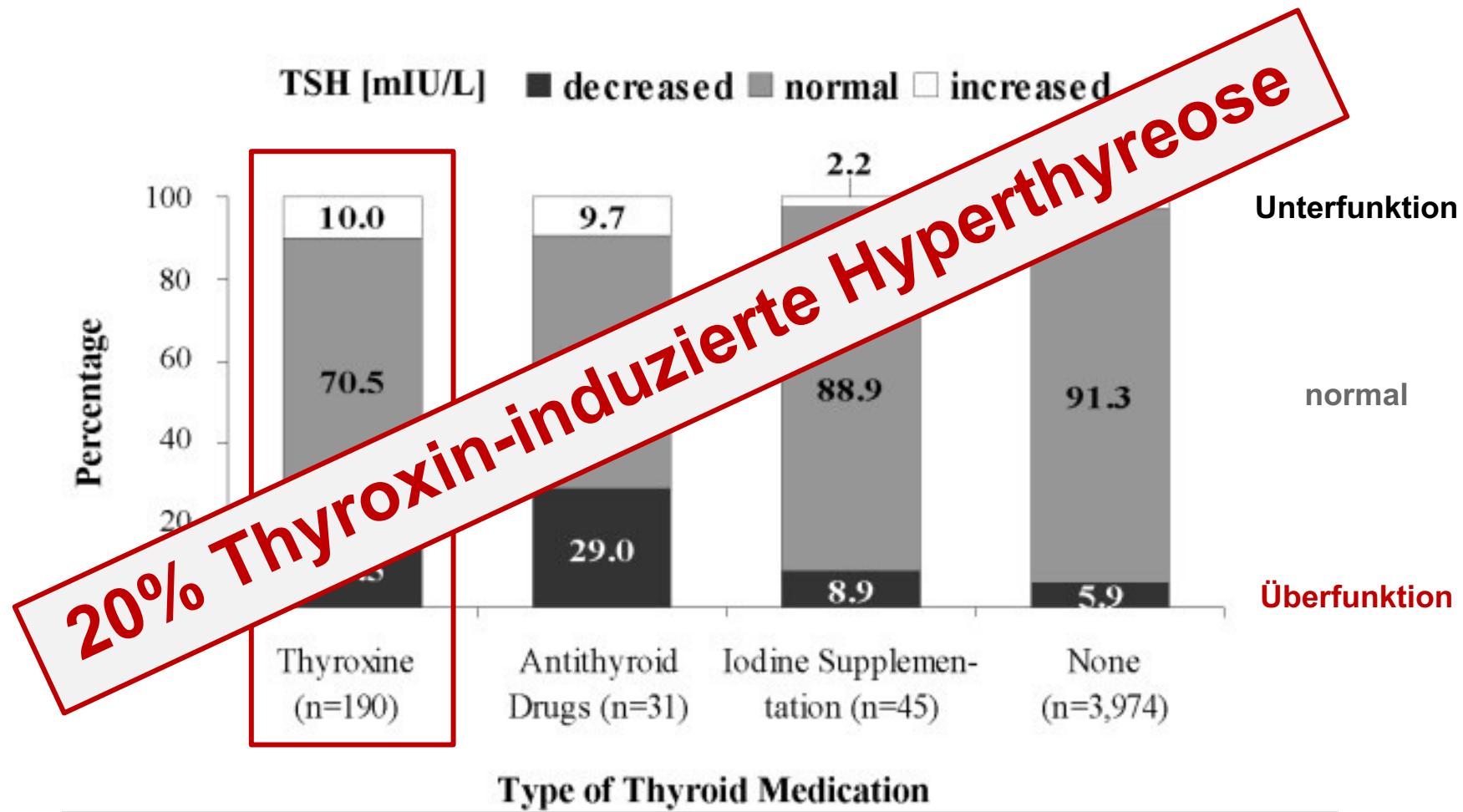
④ Treatment follow-up

- If treatment is initiated, measure thyrotropin level in 6 weeks and adjust LT_4 dose if necessary.
- Once target thyrotropin level is reached, perform annual measurement to confirm that it remains within the target range.

Finger weg von unreflektierter Schilddrüsenhormoneinnahme !!!!



Thyroid function tests in patients taking thyroid medication in Germany: Results from the population-based Study of Health in Pomerania (SHIP).

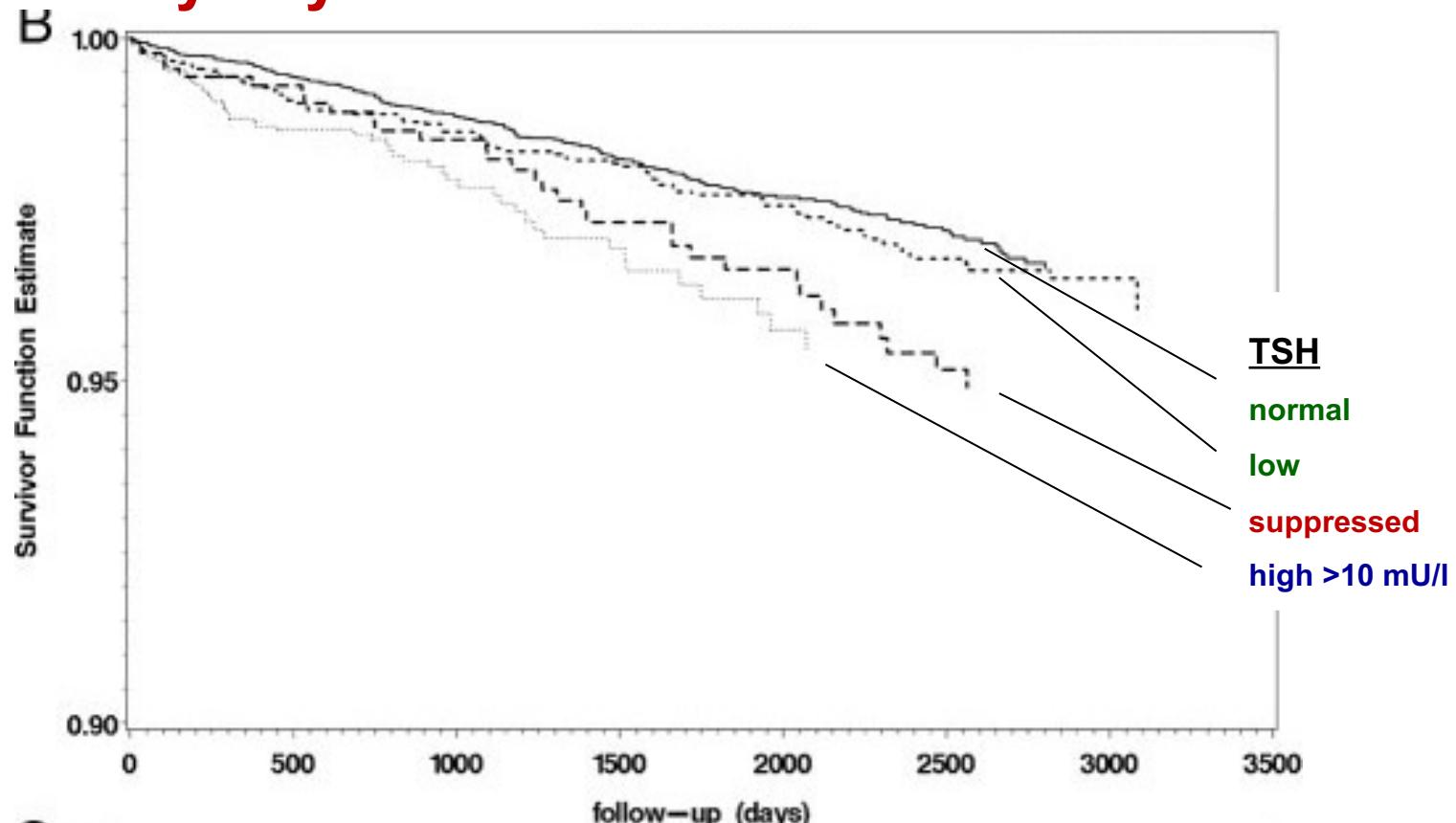


Proportion of decreased, normal and increased serum thyroid stimulating hormone (TSH) levels according to the local reference range (< 50 years: 0.27-2.15 mIU/L; ≥ 50 years: 0.19-2.19 mIU/L) by type of thyroid medication.

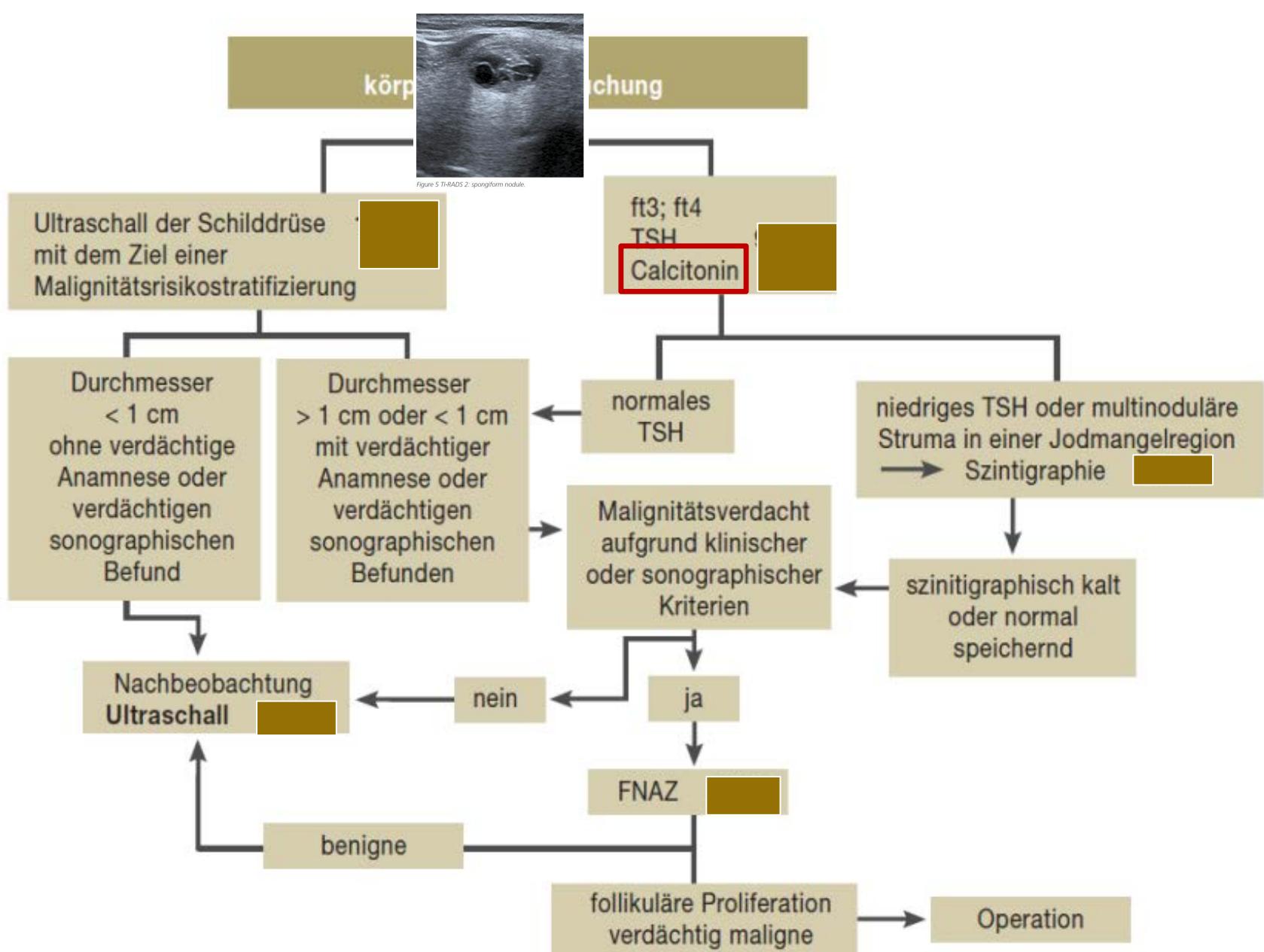
Hannemann A et al., BMC Res Notes, 2010



dysrhythmia-related admission or death



$n = 17\,684$, mittleres Alter 60 J., Follow-up 8 J.
Langfristige L-T₄-Substitutionstherapie

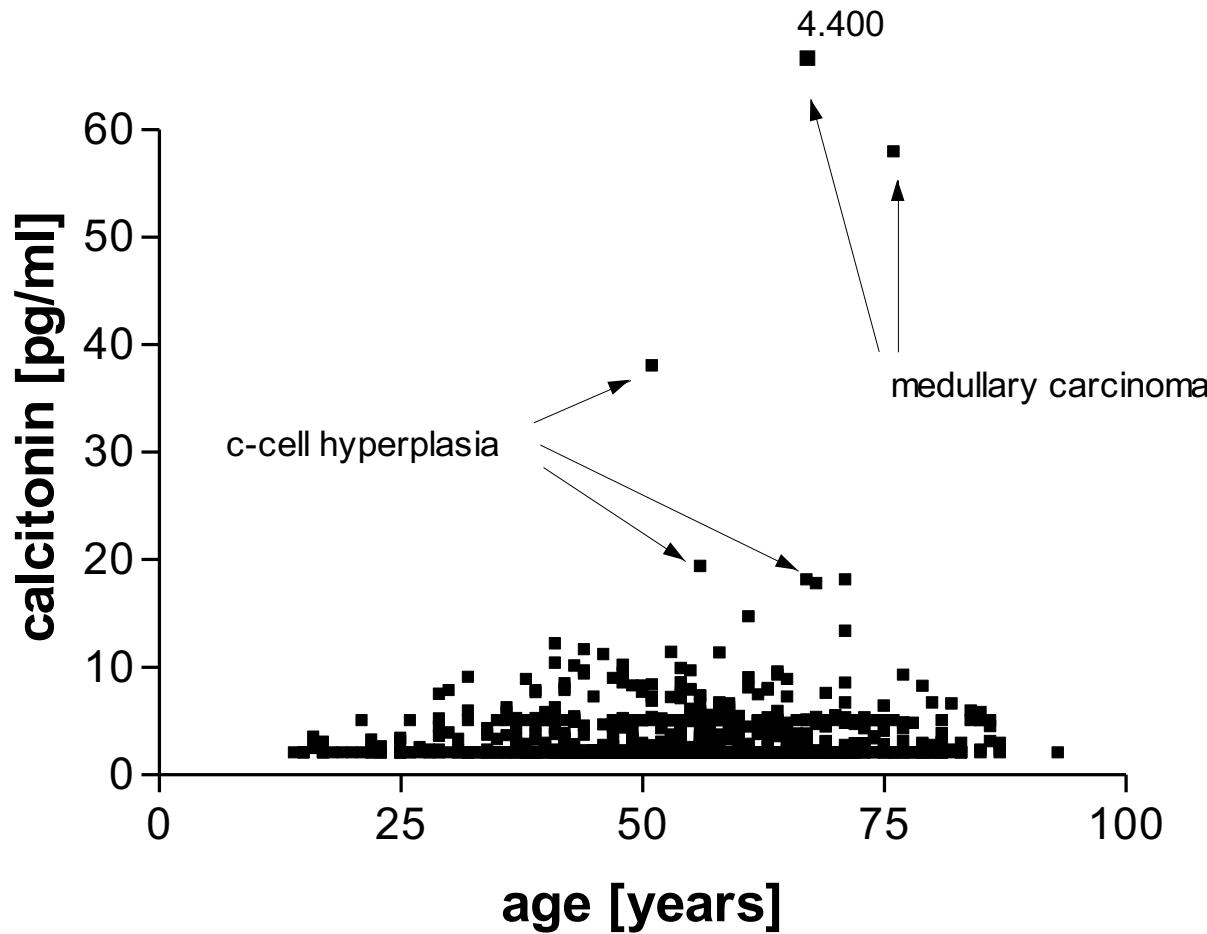


Calcitonin-Screening: Medulläres Schilddrüsen-C.A. bei SD-Knoten

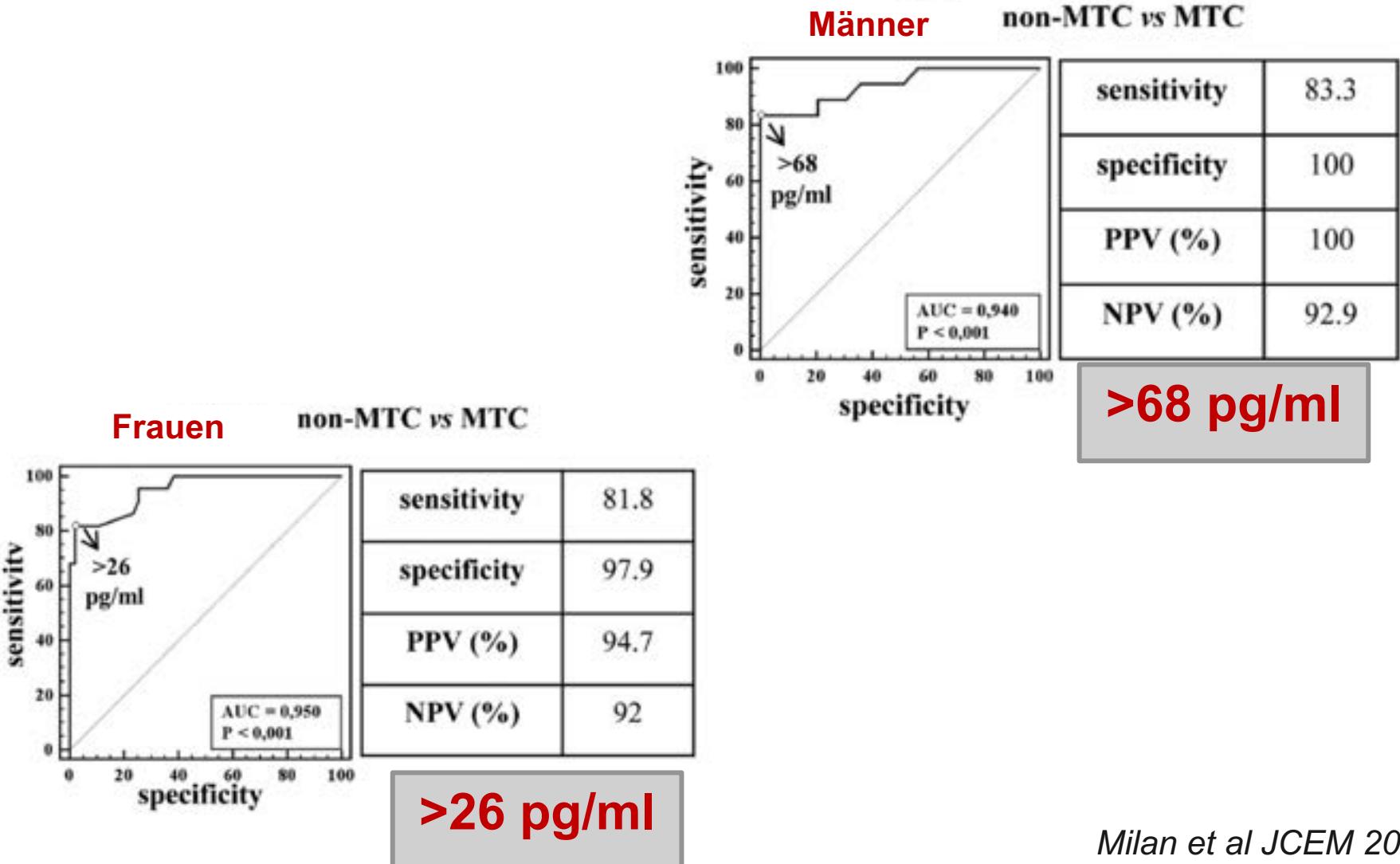
Prävalenz [%]	Journal	Autor / Jahr	Anzahl
0.32	Cochrane Database	Verbeek HHG el. al 2020	72.368
0.31	JCEM	Ahmed SRel. al 2011	15.992
0.30	Eur Thyroid	Maino F el. al 2021	3.250
0.40	J Endocrinol Met	Elisei R el. al 2004	10.864
0.20	Eur J Endocrinol	Herrmann BL el. al 2010	1.007
0.18	Thyroid	Rin T el. al 2009	21.928

Calcitonin Screening

predictive value for the diagnosis of medullary carcinoma in nodular thyroid disease



Basale Calcitonin-Spiegel [Grenzwerte]

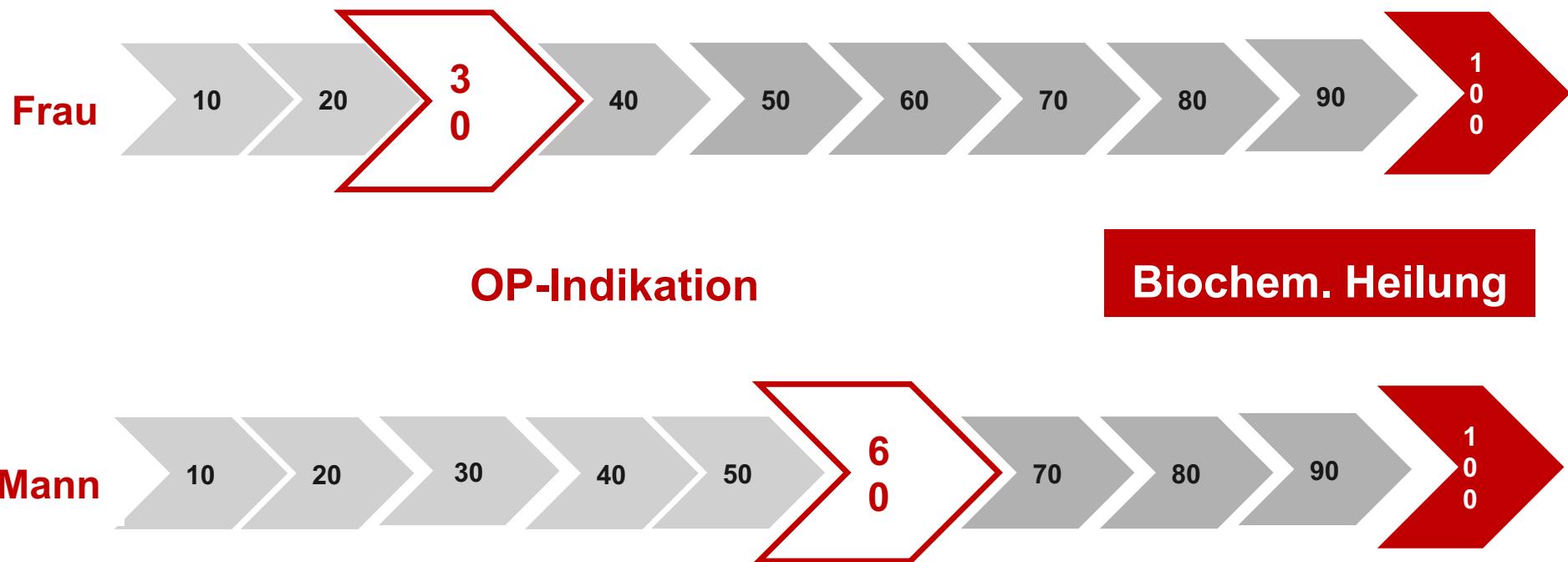


Calcitonin-Spiegel - Tu-Größe, Lk und Heilung

TABLE 3. Tumor diameter and lymph node metastases by basal calcitonin level

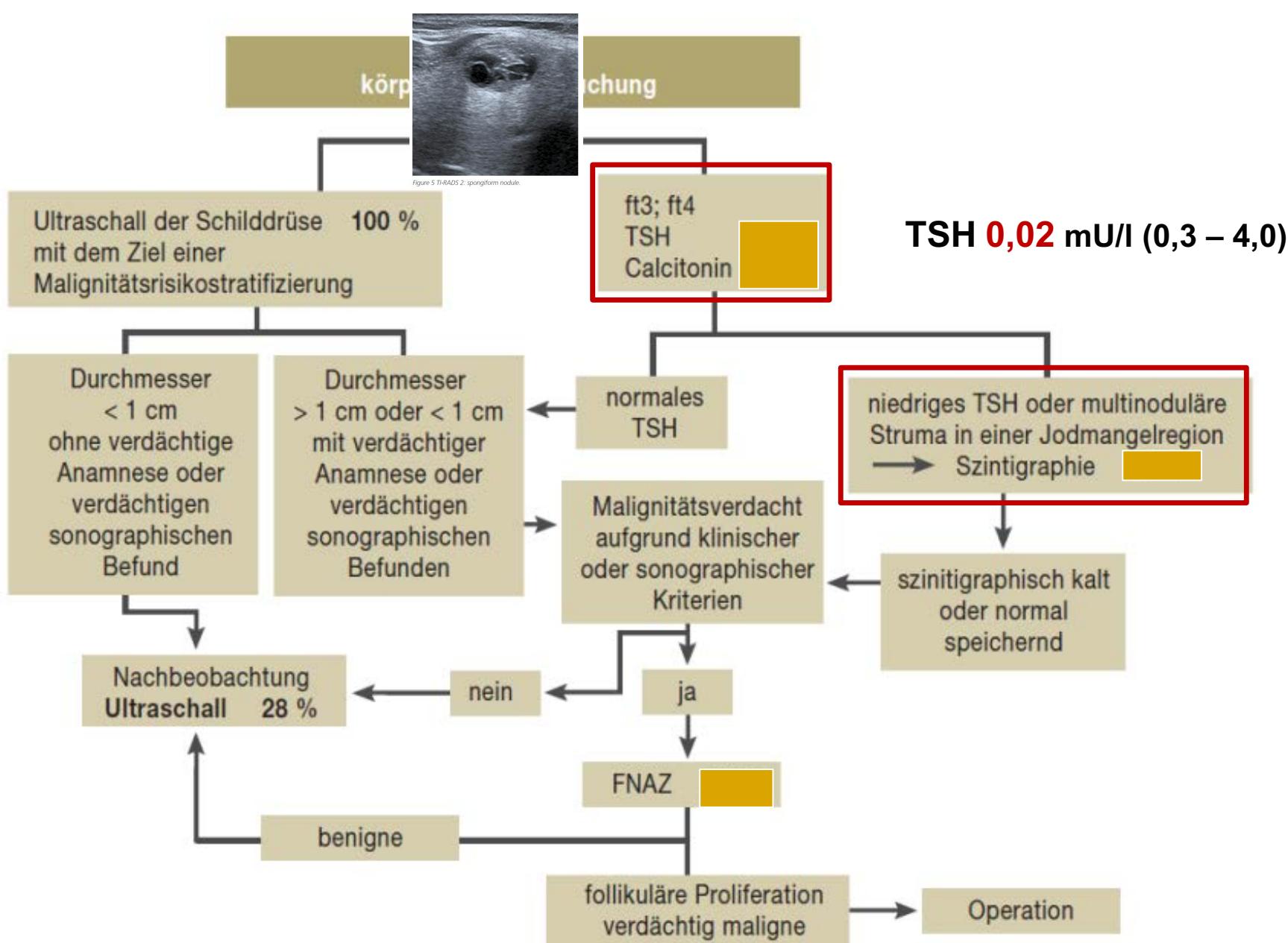
Basal calcitonin level (pg/ml)	n ^d	Largest primary tumor diameter (mm) ^a		Number of involved lymph nodes		Number of removed lymph nodes		Biochemical cure ^b n (%) ^c
		Mean (95% CI)	Range	Mean (95% CI)	Range	Mean (95% CI)	Range	
10.1–20	23	3.3 (2.4; 4.2)	1–8	0	0	8.3 (4.9; 11.7)	1–31	22 (100)
20.1–50	35	4.5 (3.6; 5.4)	1–12	0.5 (0; 1.2)	0–12	36.1 (25.0; 47.1)	1–105	31 (100)
50.1–100	23	6.2 (4.5; 7.8)	1.3–20	0.3 (0; 0.6)	0–3	54.1 (38.3; 69.9)	3–130	19 (100)
<100								
100.1–200	26	8.9 (6.7; 11.0)	2–25	1.5 (0; 2.9)	0–17	49.5 (36.8; 62.2)	1–128	17 (81)
200.1–500	29	11.4 (9.7; 13.0)	5–21	2.3 (0.9; 3.8)	0–16	64.2 (52.4; 75.9)	11–137	21 (81)
500.1–1,000	34	20.4 (15.0; 25.9)	1.5–70	7.5 (3.9; 11.1)	0–41	69.8 (58.5; 81.2)	24–158	14 (50)
1,000.1–2,000	34	24.0 (19.2; 28.8)	2–60	9.3 (4.1; 14.6)	0–56	68.2 (58.8; 77.6)	4–118	10 (40)
2,000.1–10,000	39	27.5 (23.3; 31.7)	9–55	15.9 (10.6; 21.3)	0–68	64.1 (56.1; 72.1)	8–128	6 (18)
Greater than 10,000	25	34.9 (28.3; 41.6)	12–65	35.3 (21.3; 49.4)	0–167 ^e	71.3 (52.9; 89.8)	6–209	0 (0)
Total	268	15.9 (14.2; 17.7)	1–70	8.2 (6.2; 10.3)	0–167	55.3 (51.0; 59.6)	1–209	140 (61)

Calcitonin-Spiegel: biochem. Heilung <100 pg/ml



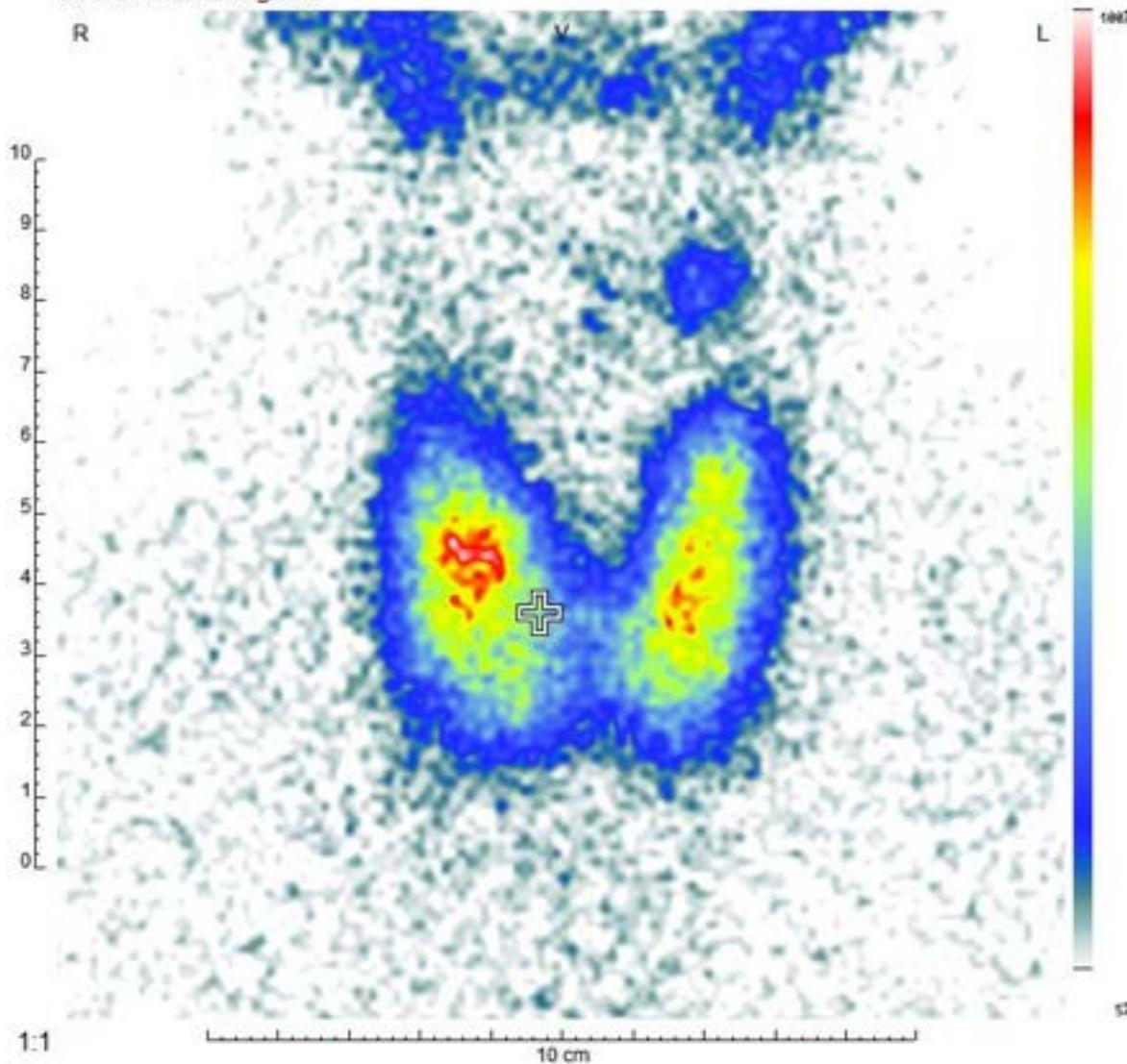
modifiziert nach Frank-Raue K et al.

Endokrinologie Sonderheft 2018



Normalbefund: 99m Technetium-Schilddrüsenszintigraphie

Schilddrüsenszintigraphie



Identifikation:
Geburtsdatum:

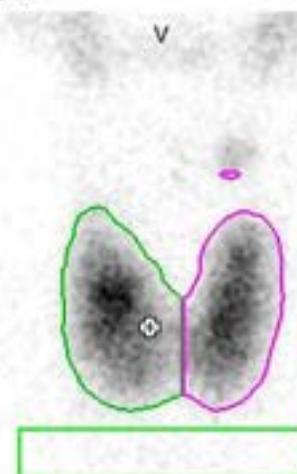
1078660
26.02.1956

R

V

L

1000



500

Kommentar:

Aufnahmedatum: 31.10.2023 12:41

Aufnahmematrix: 128x128

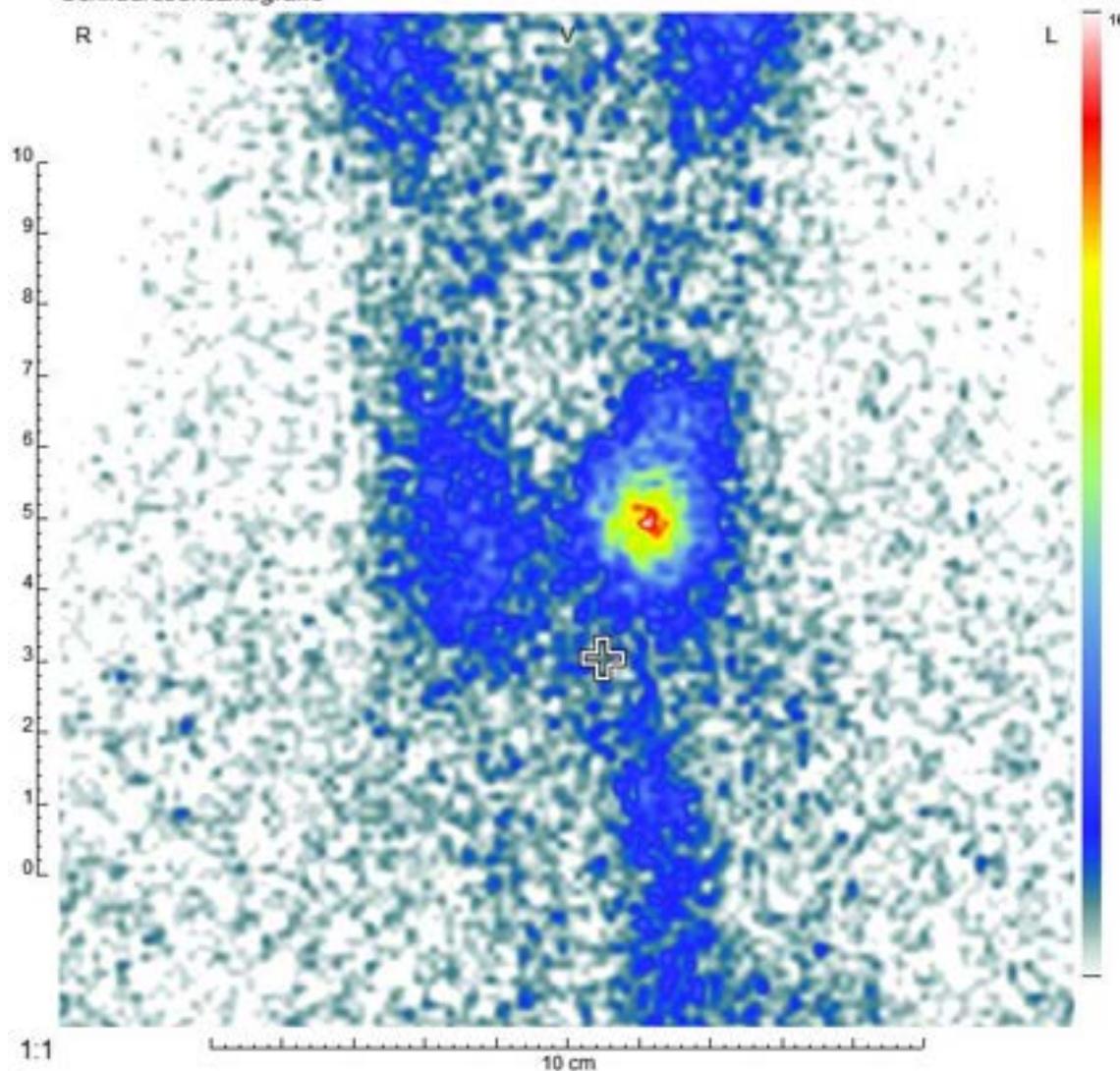
Aufnahmedauer / p.i.: 5.00min / 21min

* Tc99m *	kcts/min	MBq
Volle Spritze	341	58.0
Leere Spritze	41	7.00
Appl. Aktivität		51.0
Netto Aktivität		48.9

	F (cm ²)	TcTU	kBq/cm ²	kcts
Gesamt-SD	24.2	2.20%	44.4	37.3
Background	10.5			
Rechts	13.1	1.19%	44.2	20.2
Links	10.8	0.99%	45.1	16.9

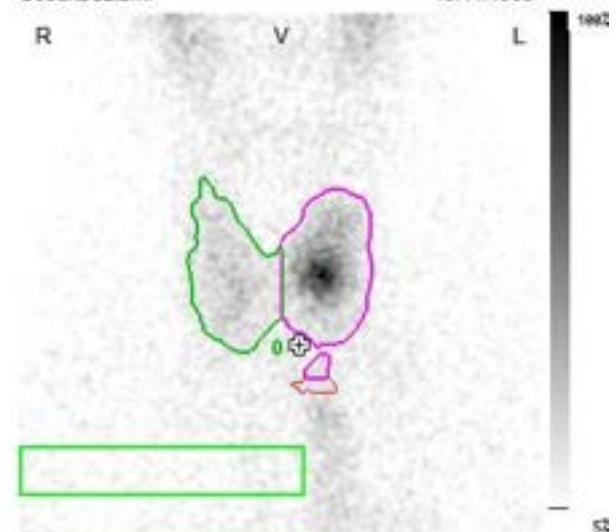
Autonomie: 99mTechnetium-Schilddrüsenszintigraphie

Schilddrüsenszintigraphie



Identifikation:
Geburtsdatum:

1056077
19.11.1963



Kommentar:

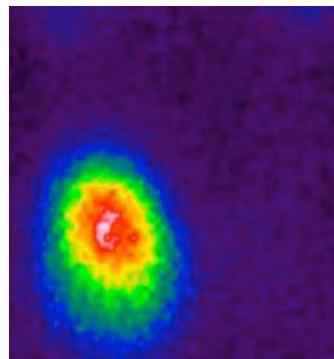
Aufnahmedatum: 25.10.2023 15:42
Aufnahmematrix: 128x128
Aufnahmedauer / p.i.: 5:00min / 20min

* Tc99m *	kcts/min	MBq
Volle Spritze	347	59.0
Leere Spritze	21	3.60
Appl. Aktivität		54.5
Netto Aktivität		52.4

	F (cm ²)	TcTU	kBq/cm ²	kcts
Gesamt-SD	16.5	0.52%	16.4	11.6
Background	10.5			
Rechts	7.5	0.16%	10.9	4.0
Links	8.6	0.35%	21.5	7.4

Therapie der Schilddrüsenautonomie

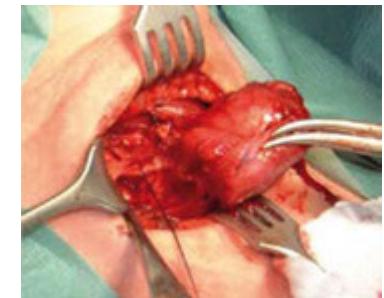
Radiojodtherapie

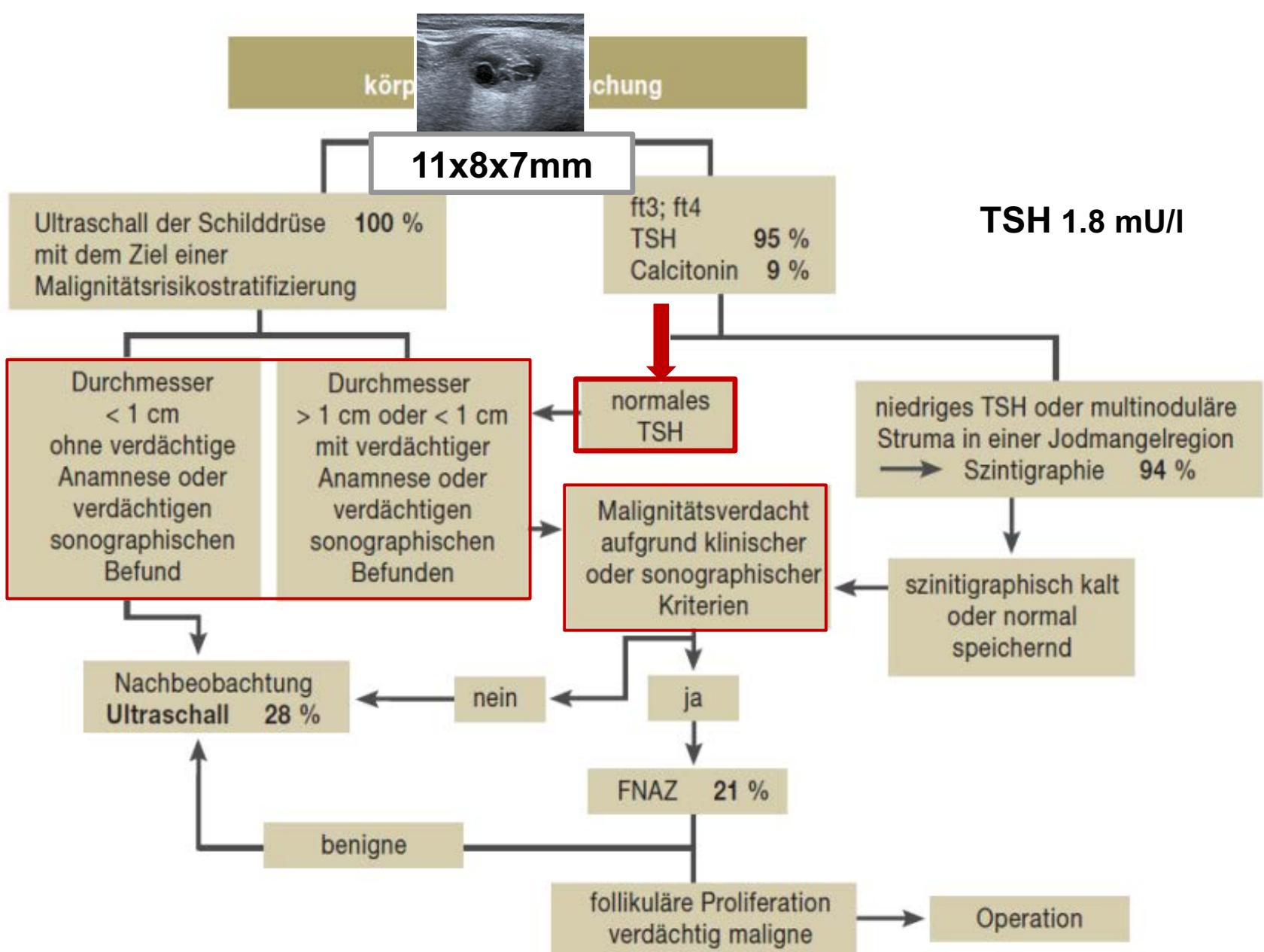


Thyreostatika

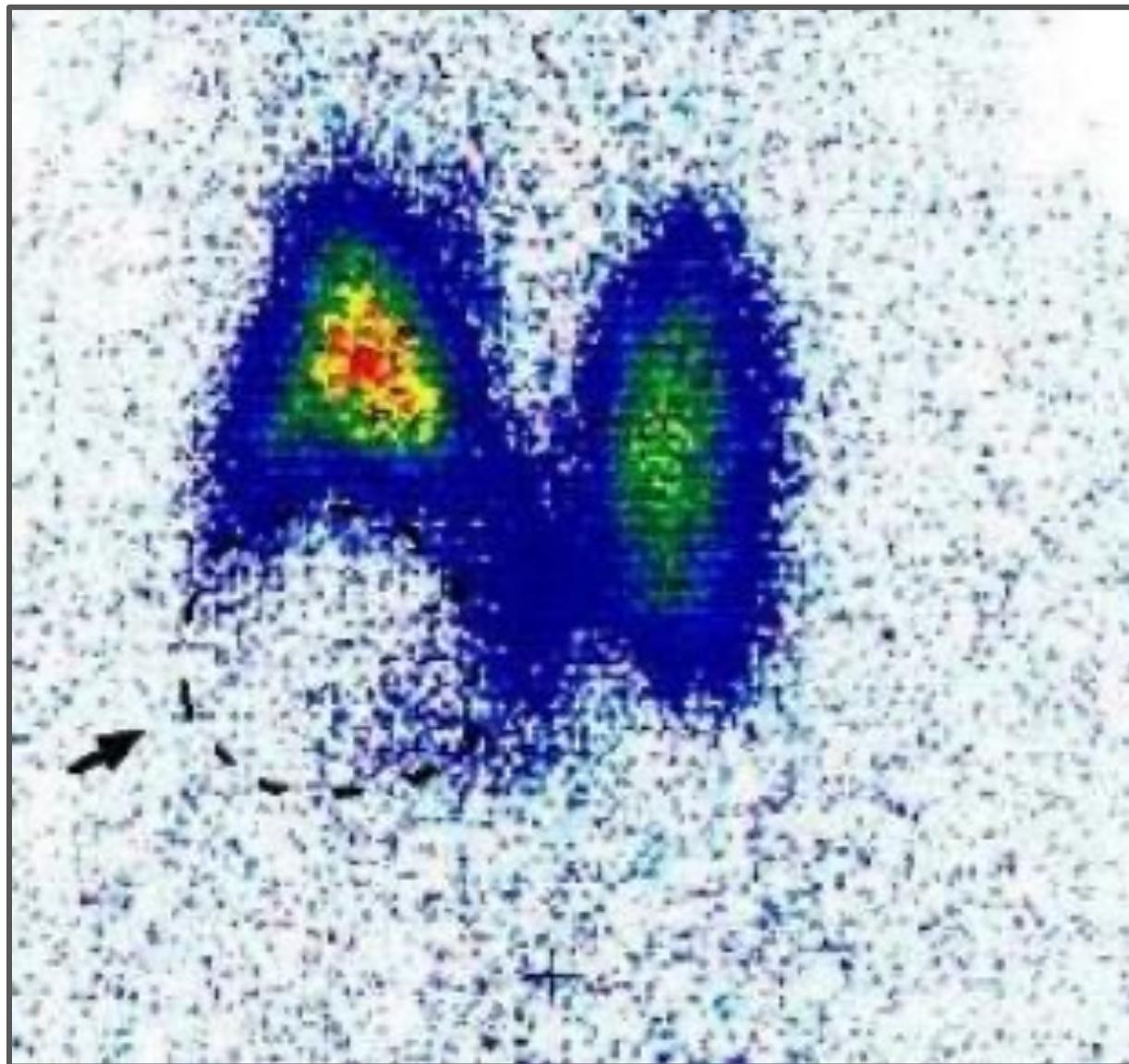


Operation

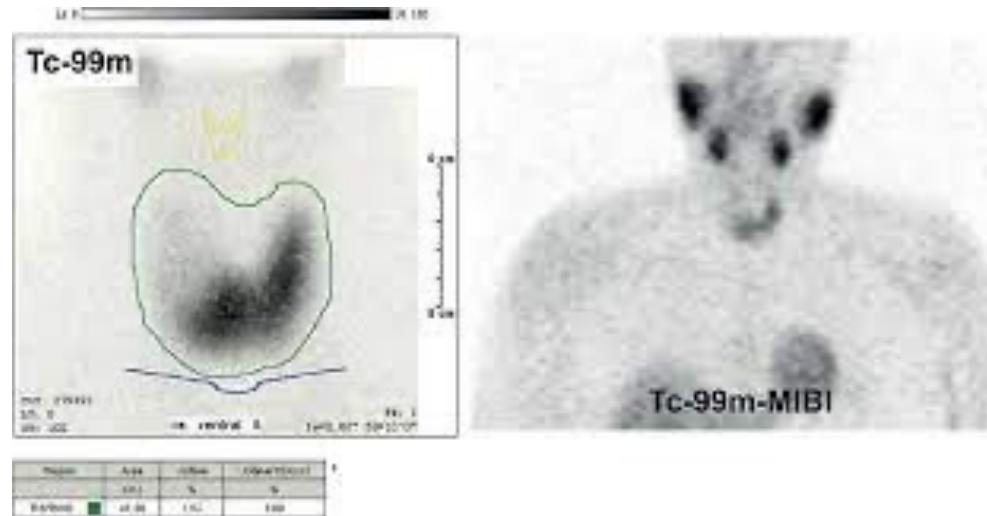




Kühler Knoten: 99m Technetium-Schilddrüsenszintigraphie

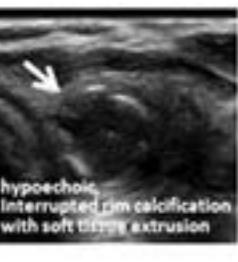
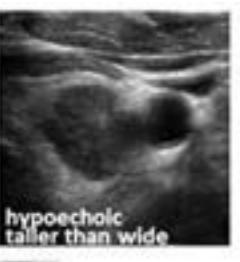


MIBI-Szintigraphie bei kalten Knoten



	MIBI (%)	FNP (%)
Sensitivität	88	60
Spezifität	54	77
pos. präd. Wert	19	23
neg. präd. Wert	97	94

High
Suspicion
 $>70\text{-}90\%$



Intermediate
Suspicion
 $10\text{-}20\%$



Low
Suspicion
 $5\text{-}10\%$



Very low
Suspicion
 $<3\%$



Benign
 $<1\%$



American Thyroid Association (ATA) nodule
sonographic patterns and risk of malignancy

2015

Risk of malignancy

TIRADS: Thyroid Imaging Reporting and Data System

ACR – ATA – AACE - EU-TIRADS – K-TIRADS

Table 2. Ability of the Five Sonographic Classification Systems to Identify Nodules Whose FNA Could Be Deferred and to Discriminate Between Benign and Malignant Nodules

	Avoided Biopsies (%) ^a	FN (FNR)	TN (TNR)	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	AUC	DOR ^b
ACR TIRADS	268 (53.4)	6/268 (2.2%)	262/268 (97.8%)	83.3 (67.2–93.6)	56.2 (51.6–60.8)	12.8 (8.8–17.8)	97.8 (95.2–99.2)	0.7 (0.62–0.78)	6.42 (2.62–15.72)
ATA	220 (43.8)	9/220 (4.1%)	211/220 (95.9%)	75 (57.8–87.9)	45.3 (40.7–49.9)	9.6 (6.4–13.6)	95.9 (92.4–98.1)	0.6 (0.51–0.69)	2.48 (1.14–5.39)
AACE/ACE/AME	175 (34.9)	5/175 (2.9%)	170/175 (97.1%)	86.1 (70.5–95.3)	36.5 (32.1–41.0)	9.5 (6.5–13.2)	97.1 (93.5–99.1)	0.61 (0.53–0.7)	3.56 (1.36–9.33)
EU-TIRADS	154 (30.7)	5/154 (3.2%)	149/154 (96.8%)	86.1 (70.5–95.3)	32 (27.8–36.4)	8.9 (6.1–12.4)	96.7 (92.6–98.9)	0.59 (0.5–0.68)	2.91 (1.11–7.64)
K-TIRADS	86 (17.1)	3/86 (3.5%)	83/86 (96.5%)	91.7 (77.5–98.2)	17.8 (14.4–21.6)	7.9 (5.5–11)	96.5 (90.2–99.3)	0.55 (0.46–0.64)	2.38 (0.71–7.96)

ACR American College of Radiology

ATA American Thyroid Association

AACE American Association of Clinical Endocrinologists

EU-TR European Thyroid Association

K-TR Korean Society of Thyroid Radiology

TIRADS: Thyroid Imaging Reporting and Data System

American College of Radiology (ACR)

ACR TI-RADS

COMPOSITION (Choose 1)

Cystic or almost completely cystic	0 points
Spongiform	0 points
Mixed cystic and solid	1 point
Solid or almost completely solid	2 points

ECHOGENICITY (Choose 1)

Anechoic	0 points
Hyperechoic or isoechoic	1 point
Hypoechoic	2 points
Very hypoechoic	3 points

SHAPE (Choose 1)

Wider-than-tall	0 points
Taller-than-wide	3 points

MARGIN (Choose 1)

Smooth	0 points
Ill-defined	0 points
Lobulated or irregular	2 points
Extra-thyroidal extension	3 points

ECHOGENIC FOCI (Choose All That Apply)

None or large comet-tail artifacts	0 points
Macrocalcifications	1 point
Peripheral (rim) calcifications	2 points
Punctate echogenic foci	3 points

Add Points From All Categories to Determine TI-RADS Level

0 Points

TR1
Benign
No FNA

2 Points

TR2
Not Suspicious
No FNA

3 Points

TR3
Mildly Suspicious
FNA if ≥ 2.5 cm
Follow if ≥ 1.5 cm

4 to 6 Points

TR4
Moderately Suspicious
FNA if ≥ 1.5 cm
Follow if ≥ 1 cm

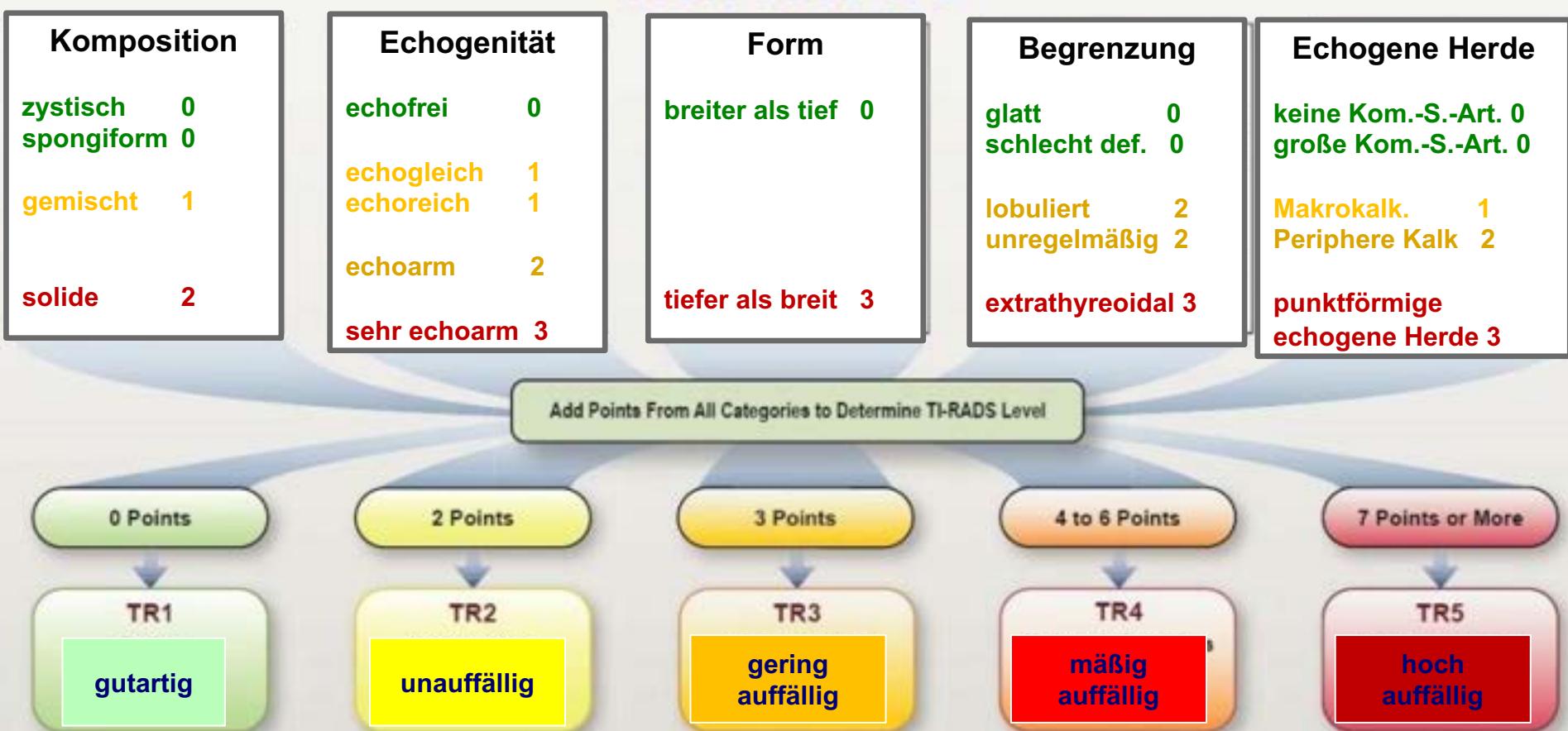
7 Points or More

TR5
Highly Suspicious
FNA if ≥ 1 cm
Follow if ≥ 0.5 cm*

TIRADS: Thyroid Imaging Reporting and Data System

American College of Radiology (ACR)

ACR TI-RADS



FNP

beobachten

$\geq 2.5 \text{ cm}$

$\geq 1.5 \text{ cm}$

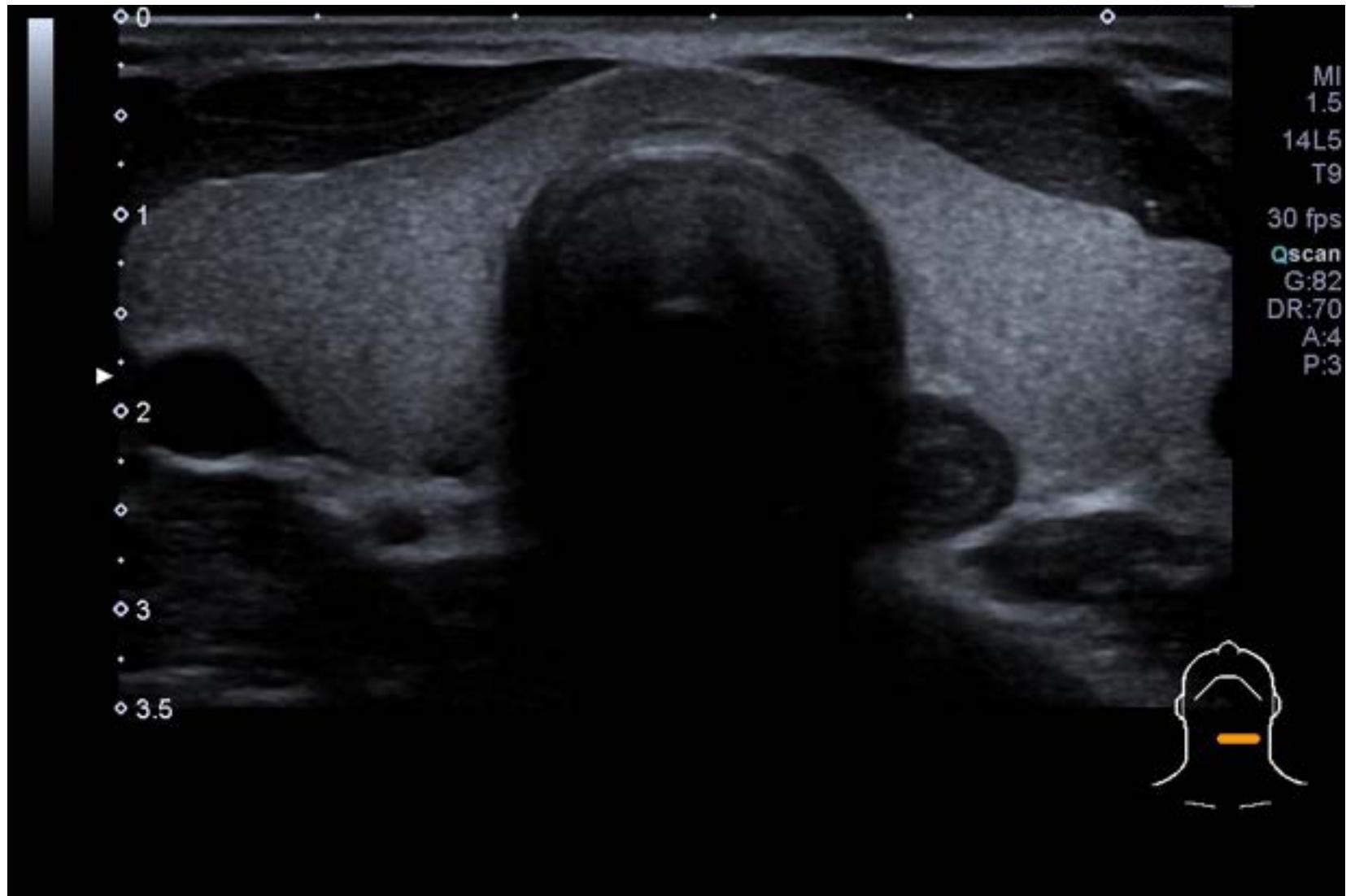
$\geq 1.5 \text{ cm}$

$\geq 1.0 \text{ cm}$

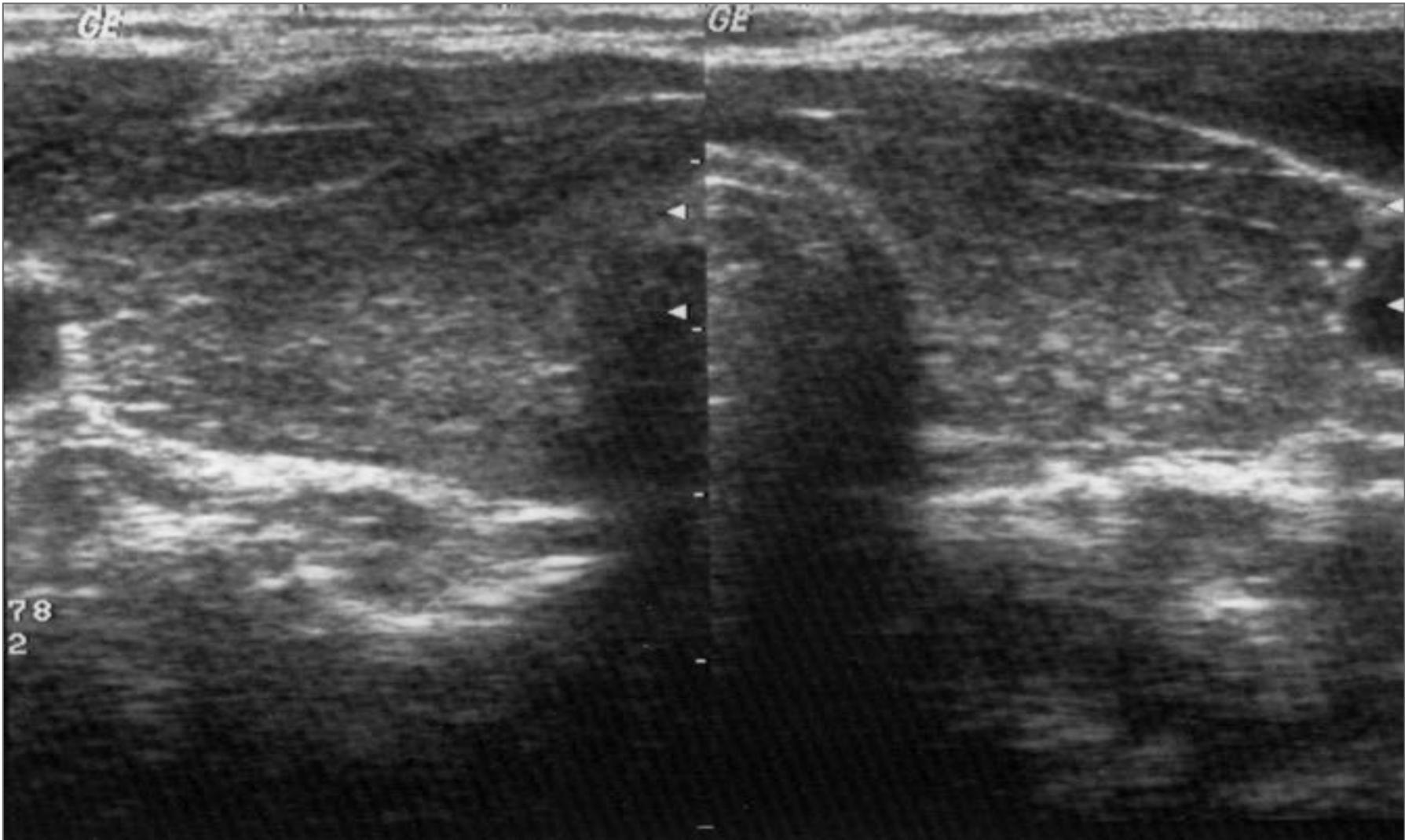
$\geq 1.0 \text{ cm}$

$\geq 0.5 \text{ cm}$

Normalbefund Schilddrüse

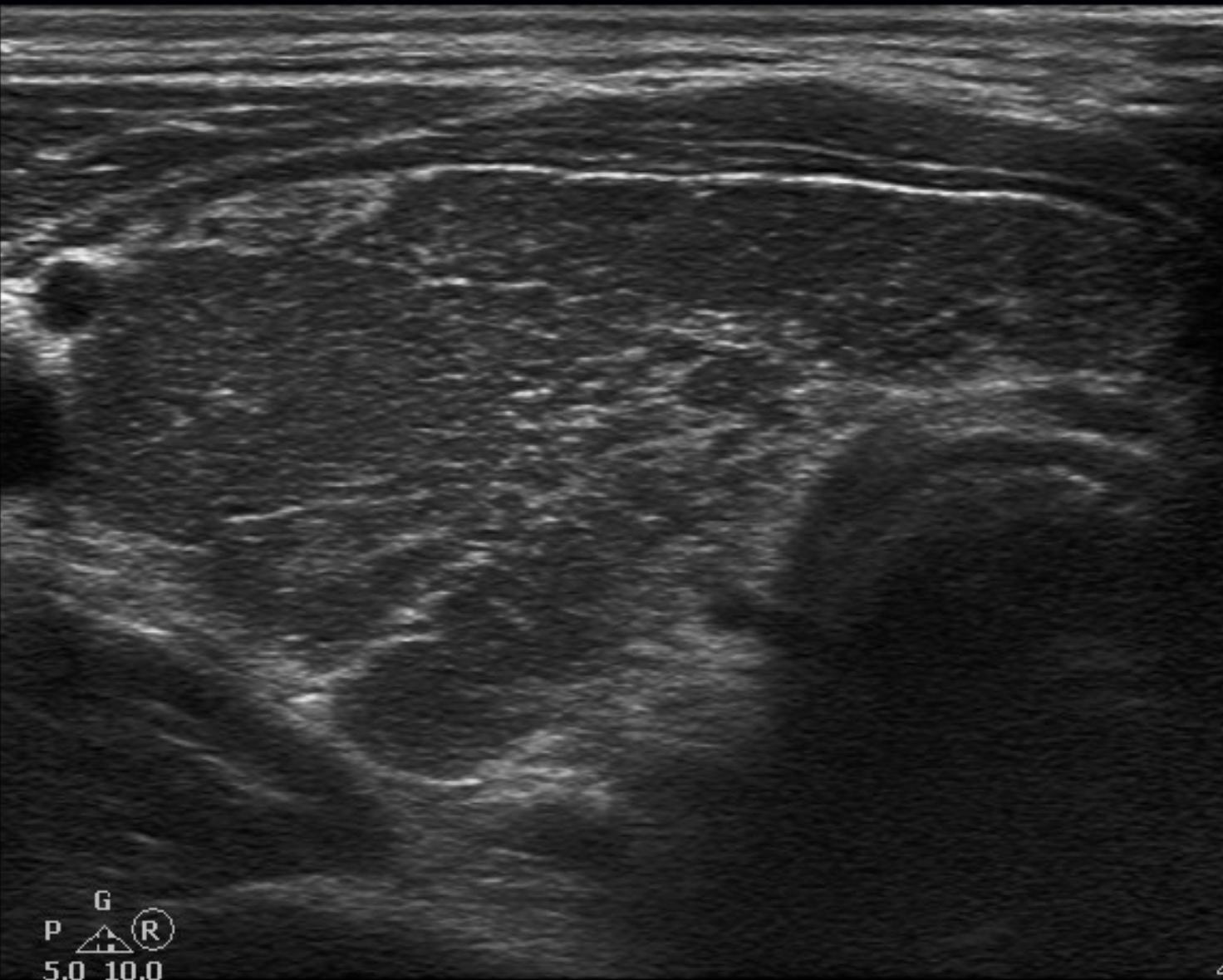


Autoimmun-Thyreoiditis (Hashimoto)



TIS 0,0

P



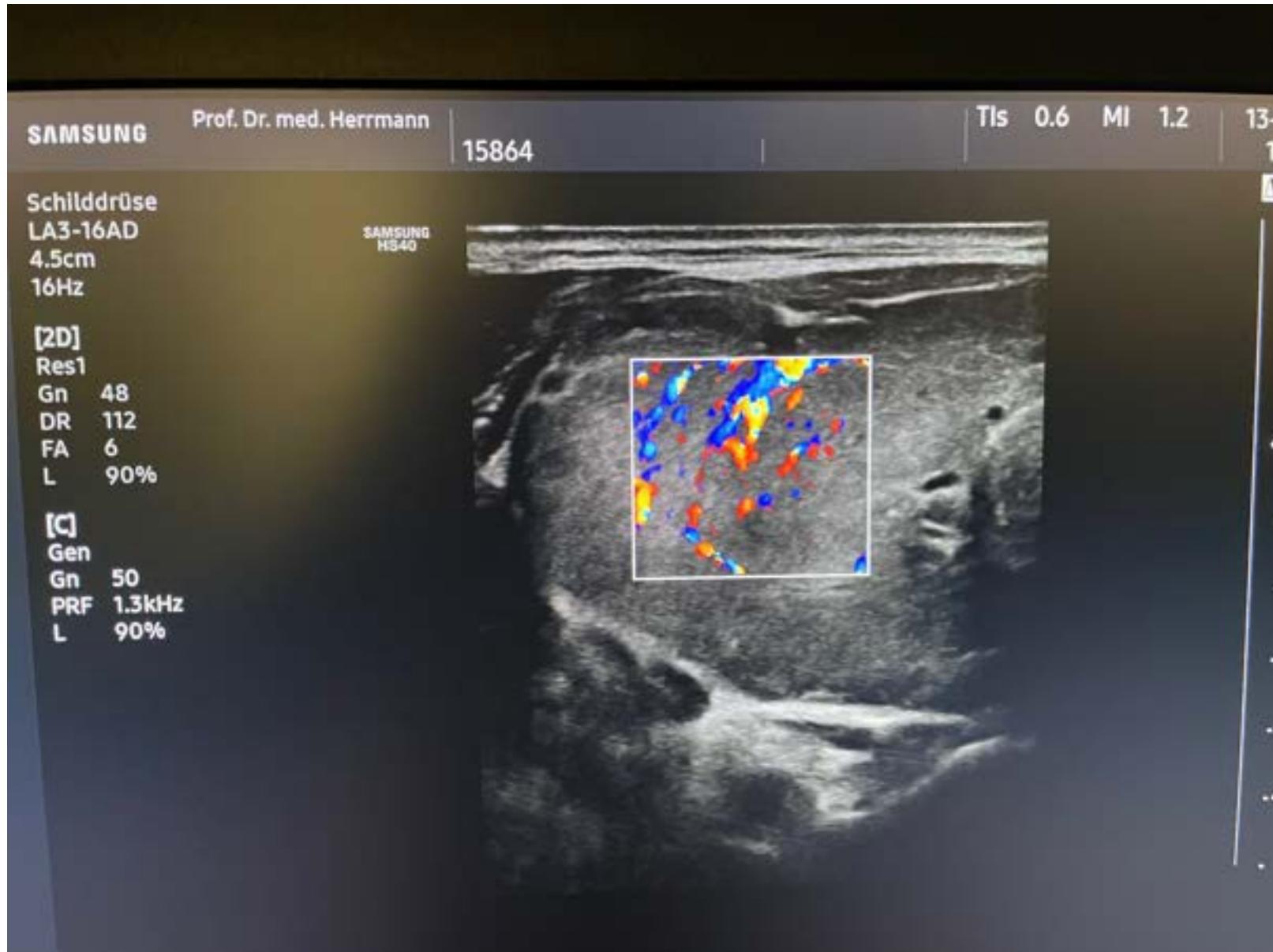
↓

2

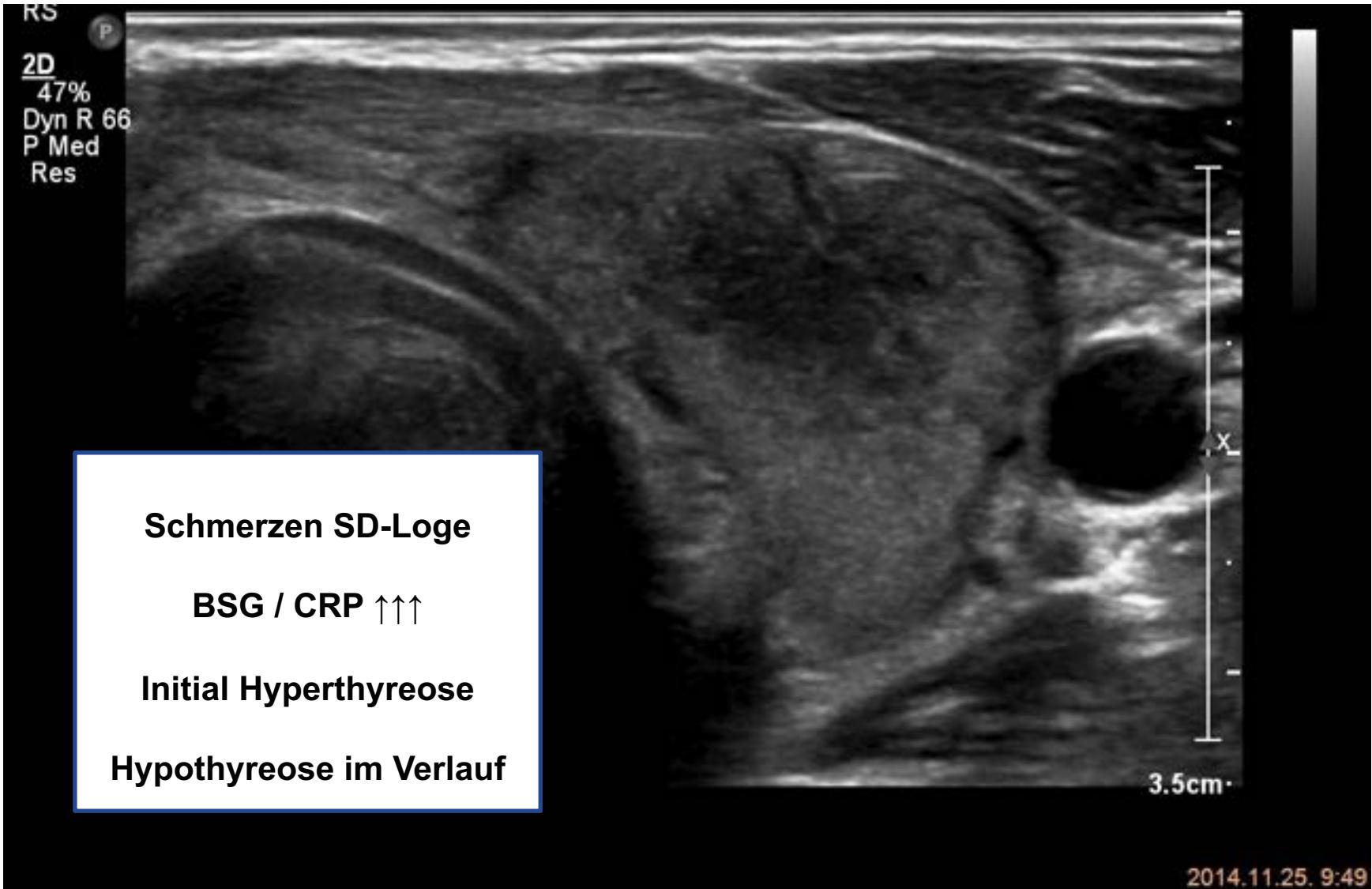
G
P ▲ R
5,0 10,0

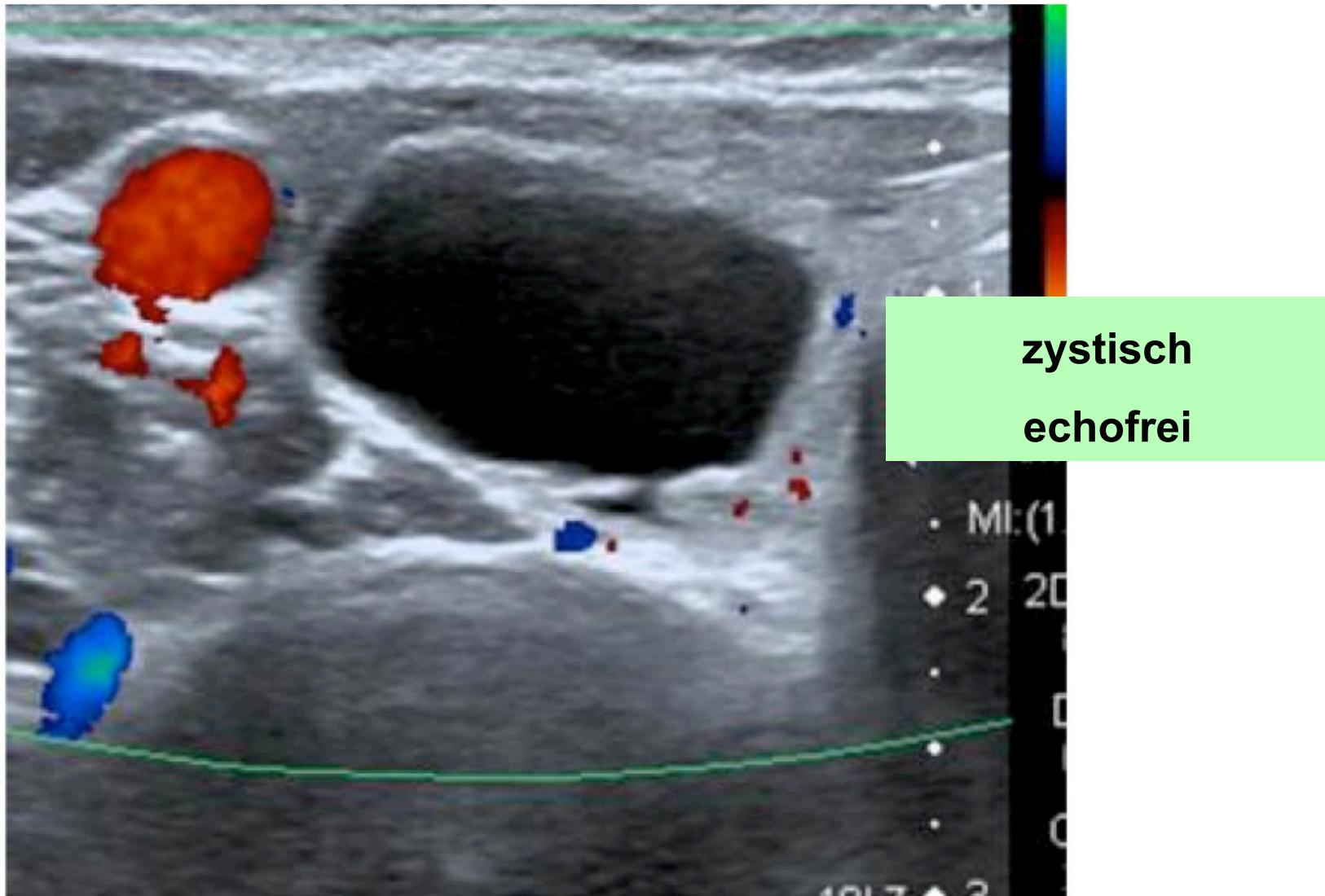
4,0cm

Morbus Basedow



De Quervain Thyreoiditis





**zystisch
echofrei**

• Mf:(1

• 2 20

121.7 ▲ 3

TIRADS: Thyroid Imaging Reporting and Data System

American College of Radiology (ACR)

ACR TI-RADS

Komposition

zystisch	0
spongiform	0
gemischt	1
solide	2

Echogenität

echofrei	0
echogleich	1
echoreich	1
echoarm	2
sehr echoarm	3

Scoring System:

- 0 Points: TR1, gutartig
- 2 Points: TR2, unauffällig

Color-Coded Risk Scale:

- S.-Art. 0 (green)
- S.-Art. 0 (green)
- 1 (yellow)
- 2 (orange)
- 3 (red)

Ultrasound Scan: A grayscale image of a prostate biopsy core. A color map overlay shows areas of high (red/yellow), intermediate (orange), and low (blue) risk. A green line marks the edge of the core. A legend on the right indicates depth in cm (0-20) and distance in mm (0-10).

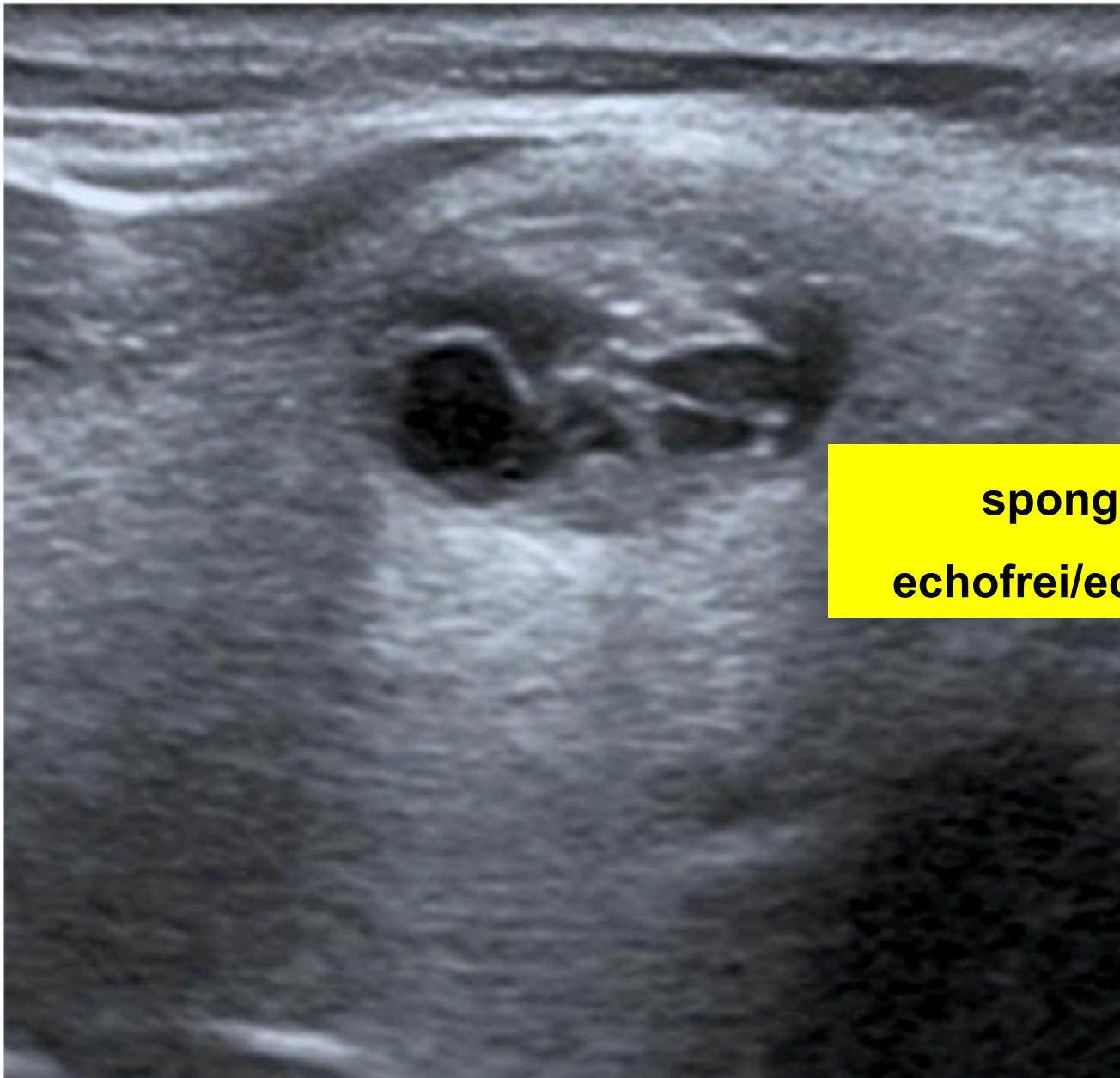
ACR-TIRADS 1

bachten

≥ 2.5 cm
 ≥ 1.5 cm

$\geq 1.5\text{cm}$

$\geq 1.0\text{cm}$



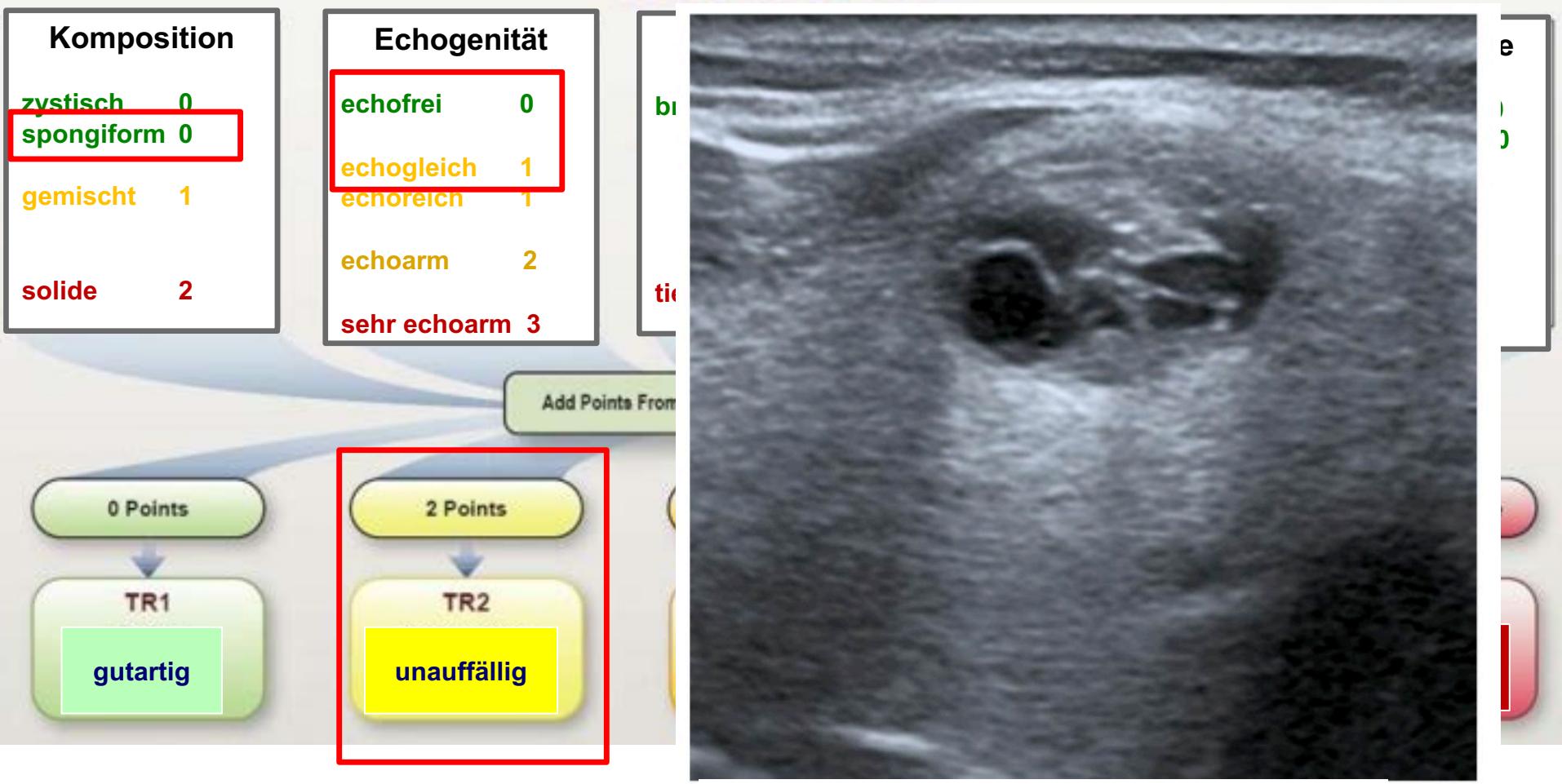
spongiform

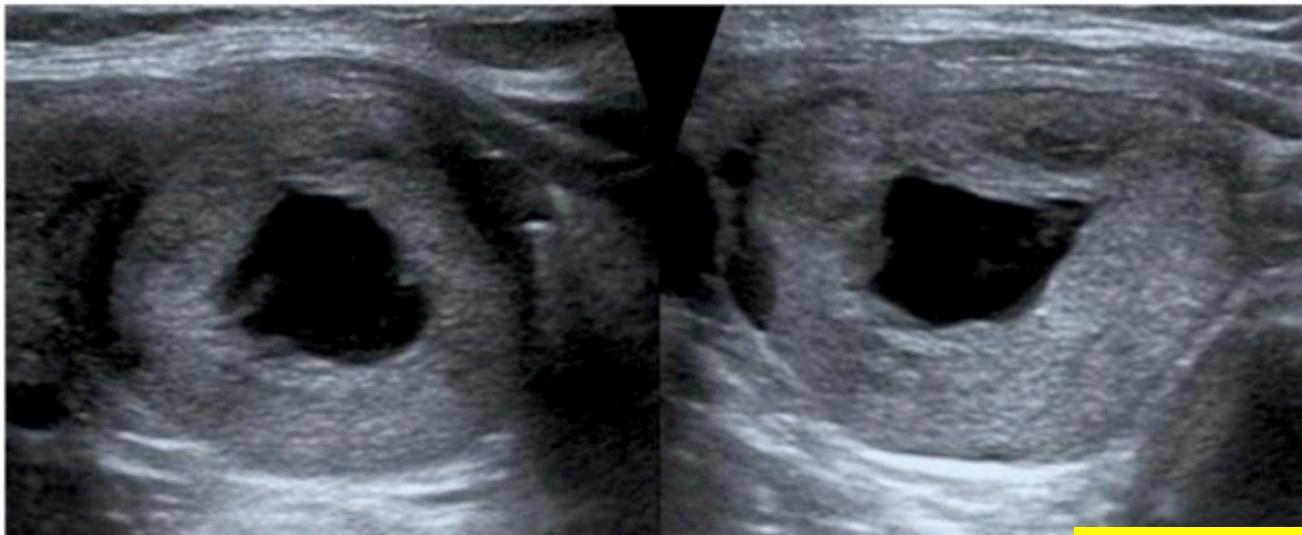
echofrei/echogleich

TIRADS: Thyroid Imaging Reporting and Data System

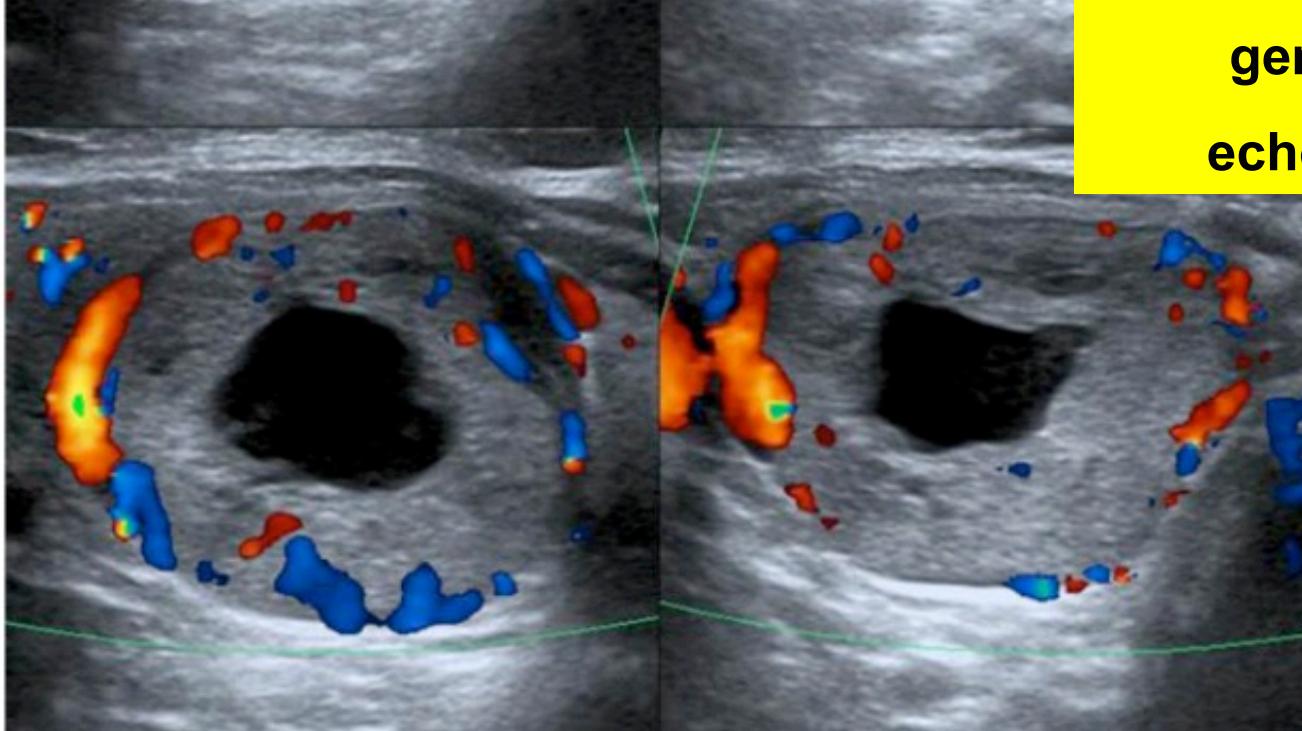
American College of Radiology (ACR)

ACR TI-RADS





**gemischt
echogleich**



TIRADS: Thyroid Imaging Reporting and Data System

American College of Radiology (ACR)

ACR TI-RADS

Komposition

zystisch 0
spongiform 0

gemischt 1

solide 2

Echogenität

echofrei 0

echogleich 1

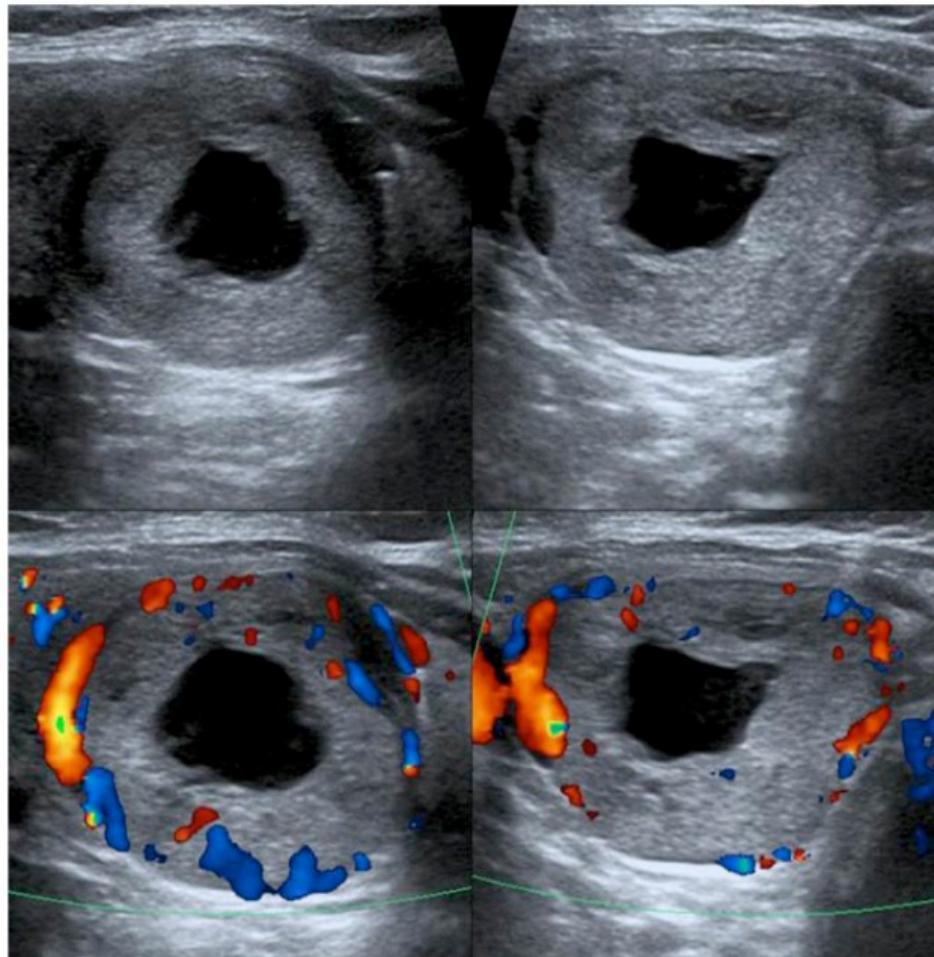
echoreich 1

echoarm 2

sehr echoarm 3

breite

tiefer



Add Points From All C

0 Points

TR1

gutartig

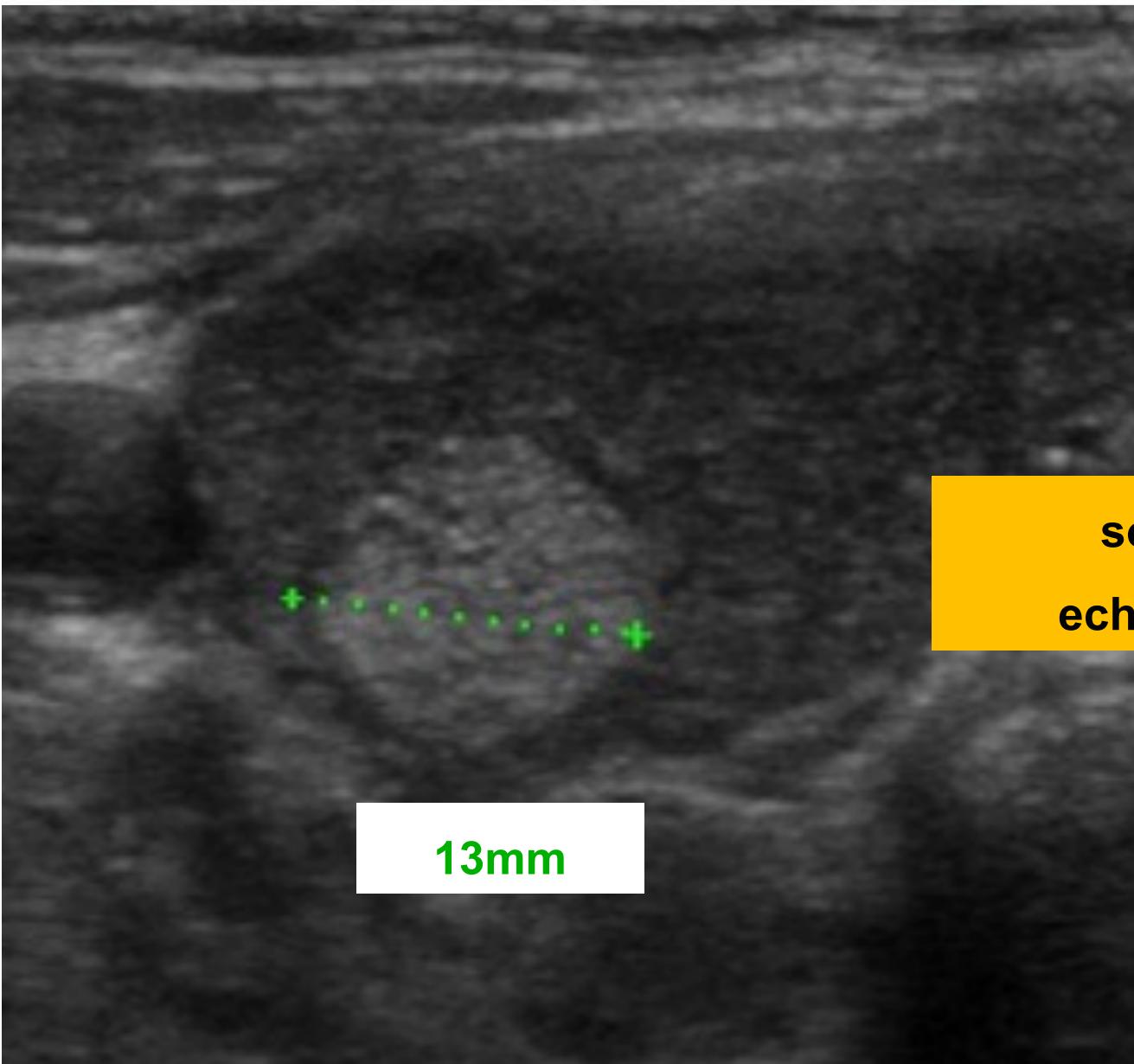
2 Points

TR2

unauffällig

ACR-TIRADS 2

beobachtet



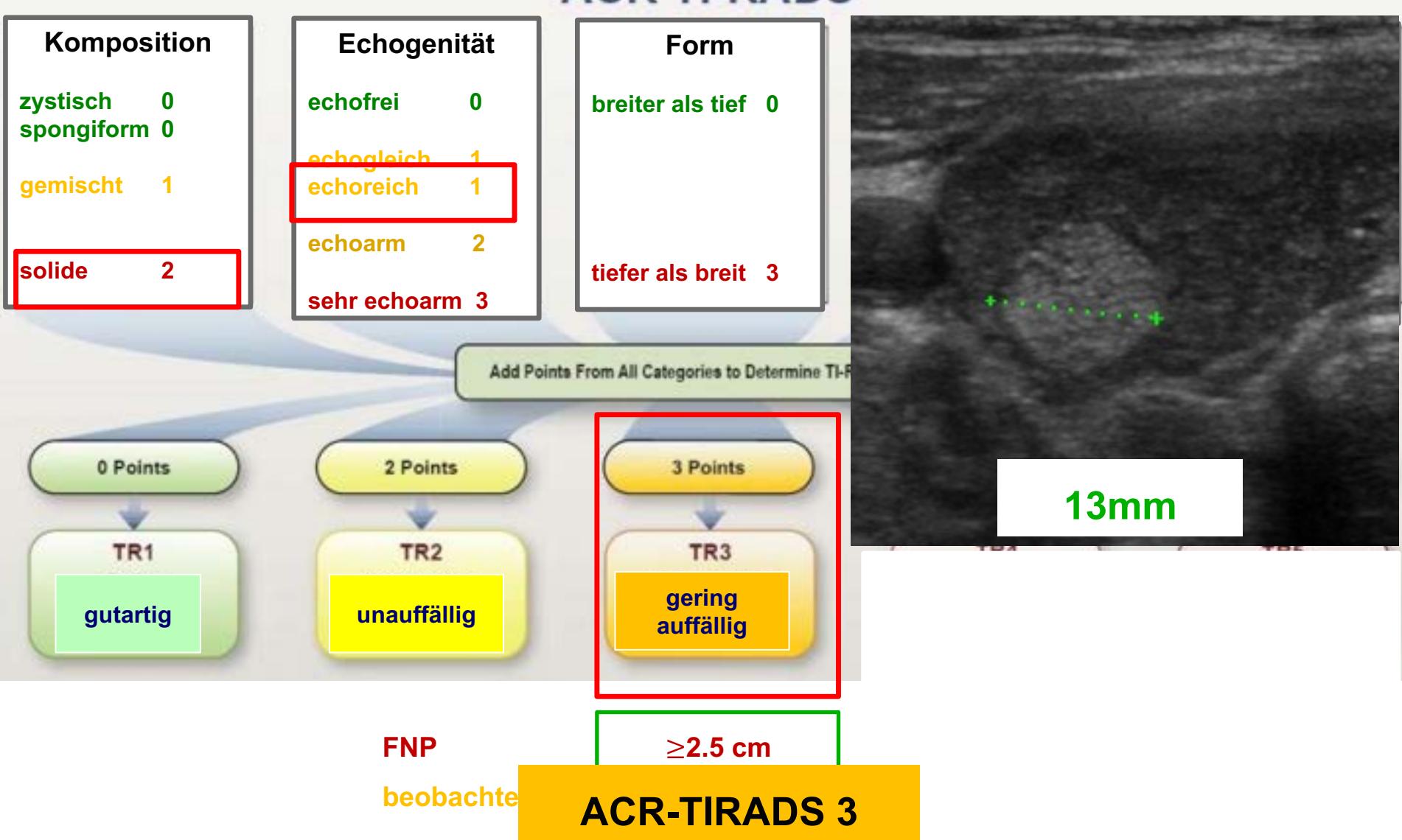
**solide
echoreich**

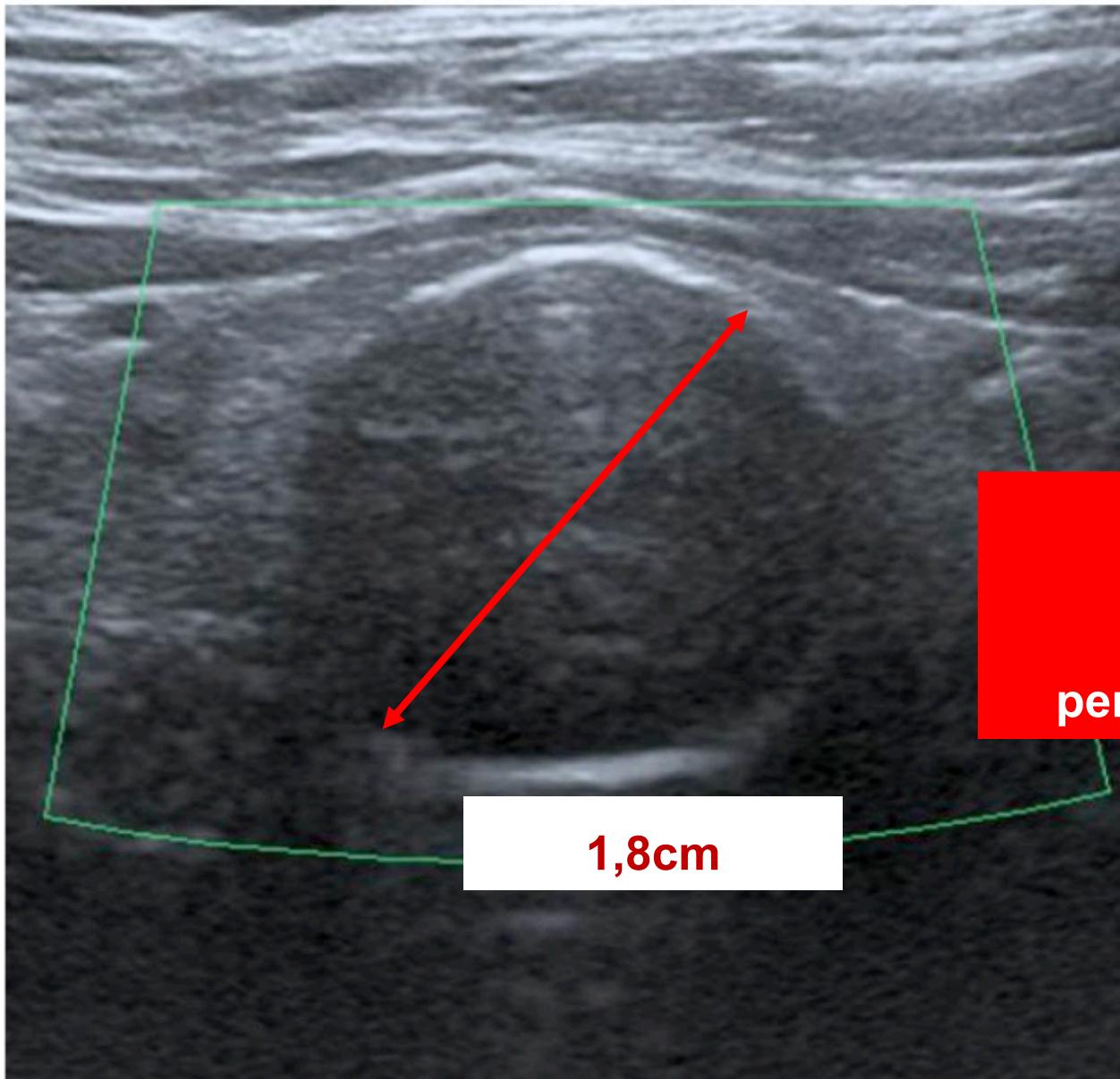
13mm

TIRADS: Thyroid Imaging Reporting and Data System

American College of Radiology (ACR)

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solide

echoarm

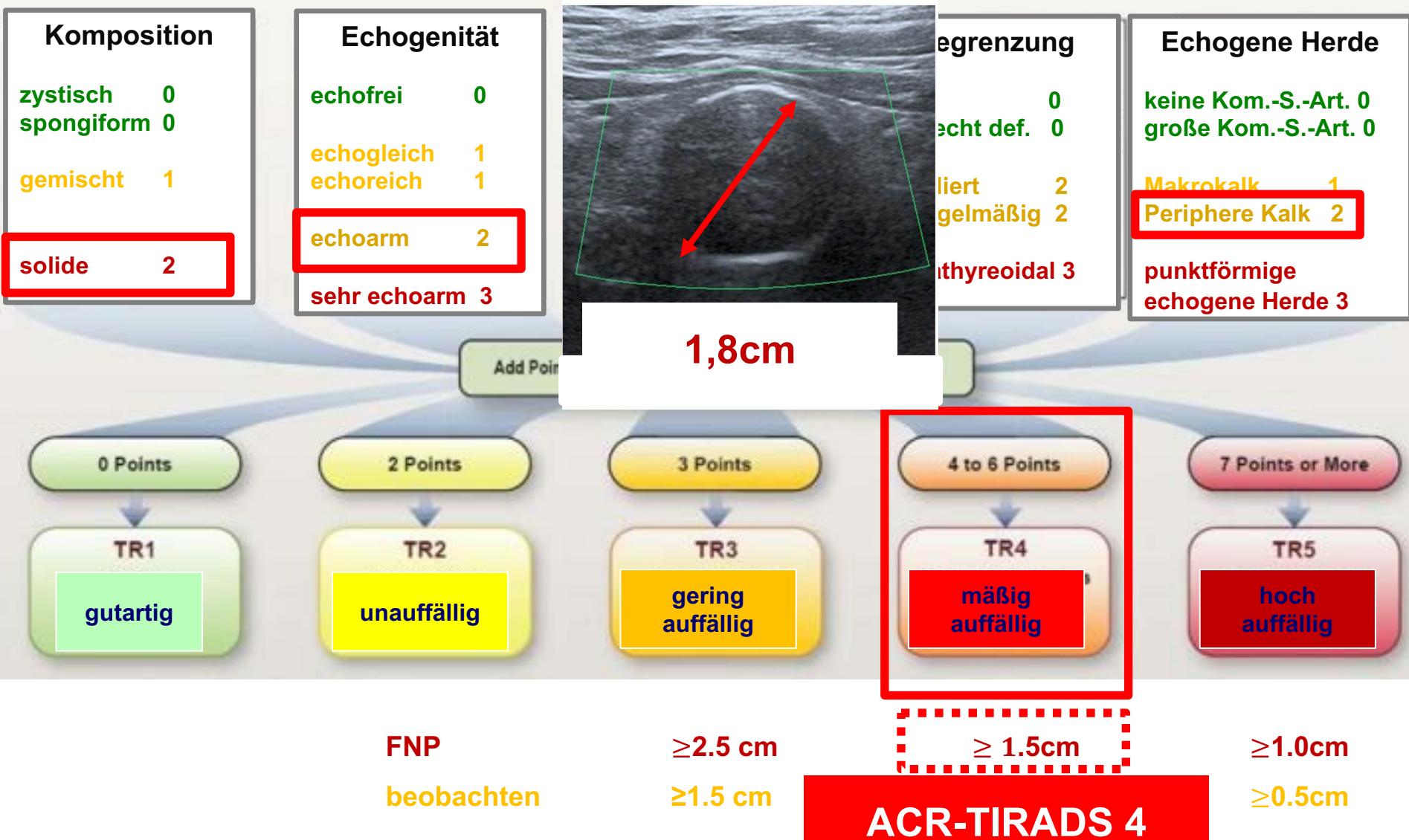
peripherie Kalk

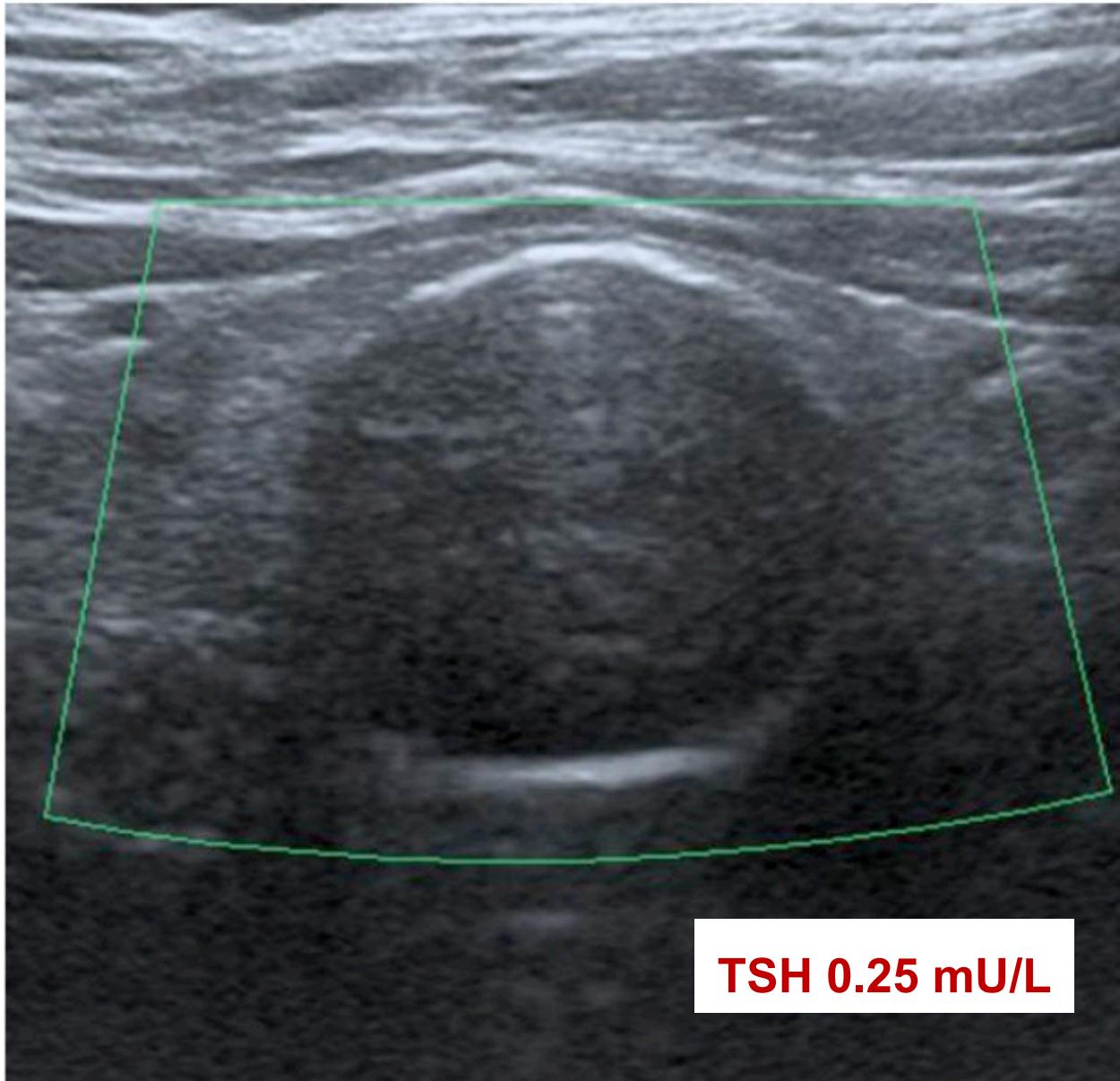
1,8cm

TIRADS: Thyroid Imaging Reporting and Data System

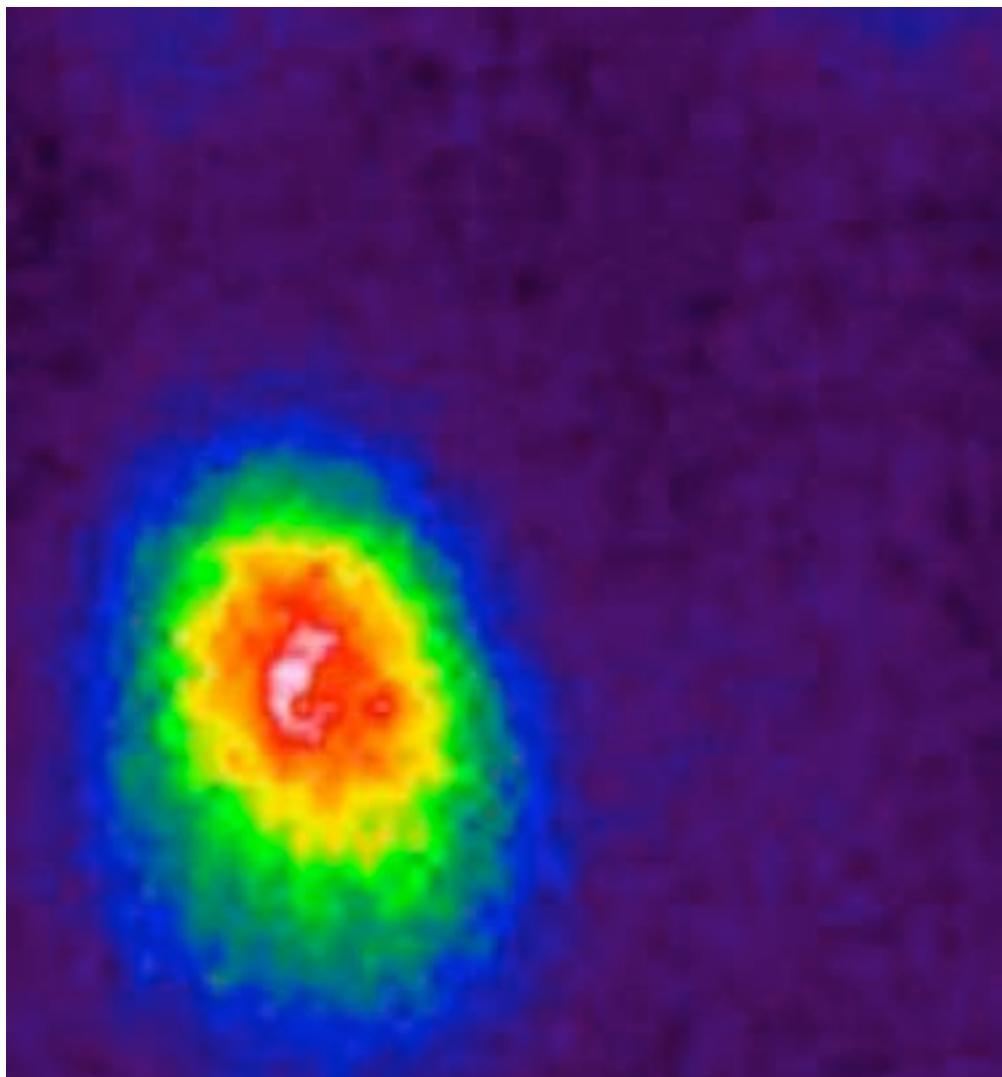
American College of Radiology (ACR)

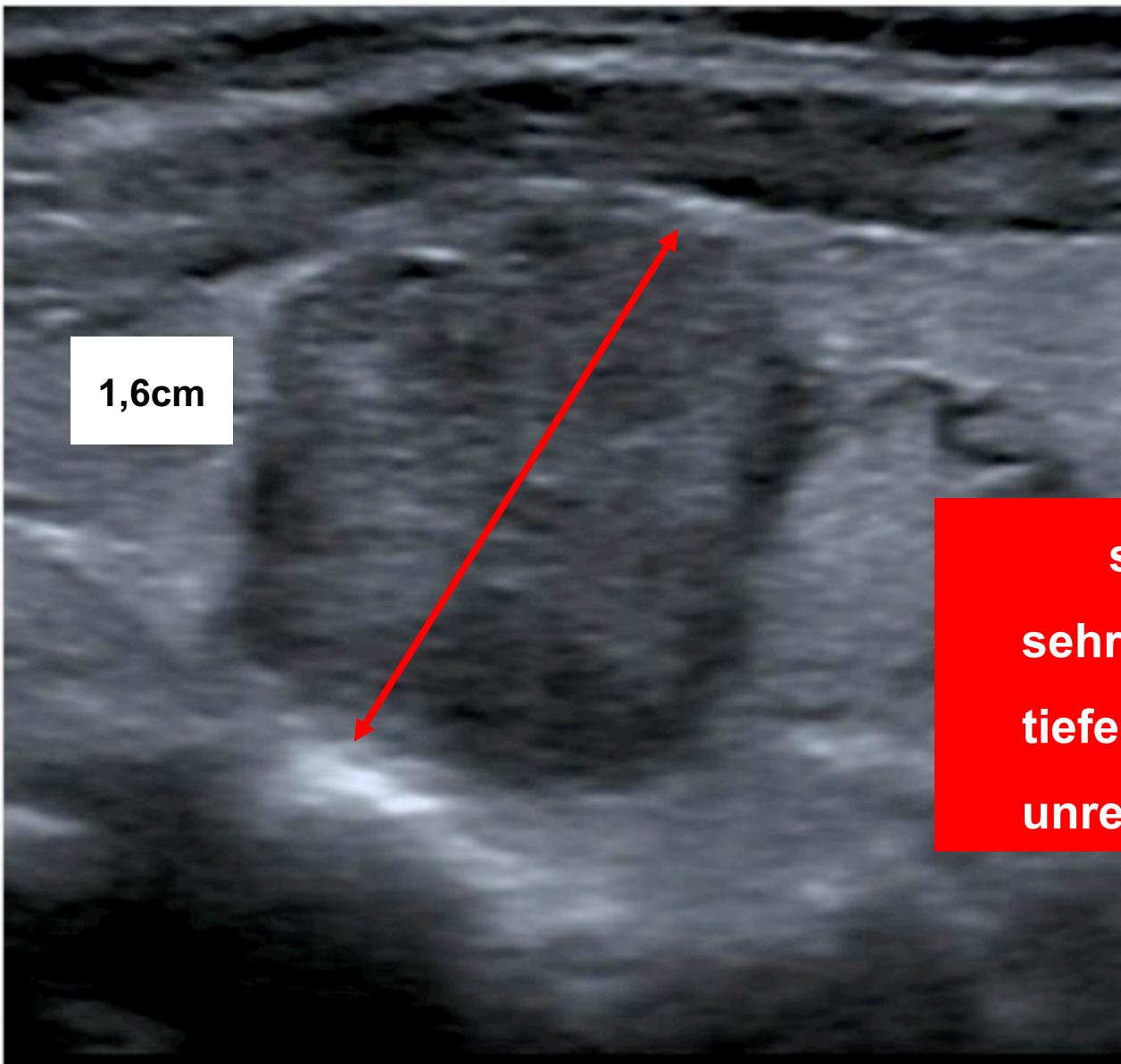
ACR TI-RADS





TSH 0.25 mU/L



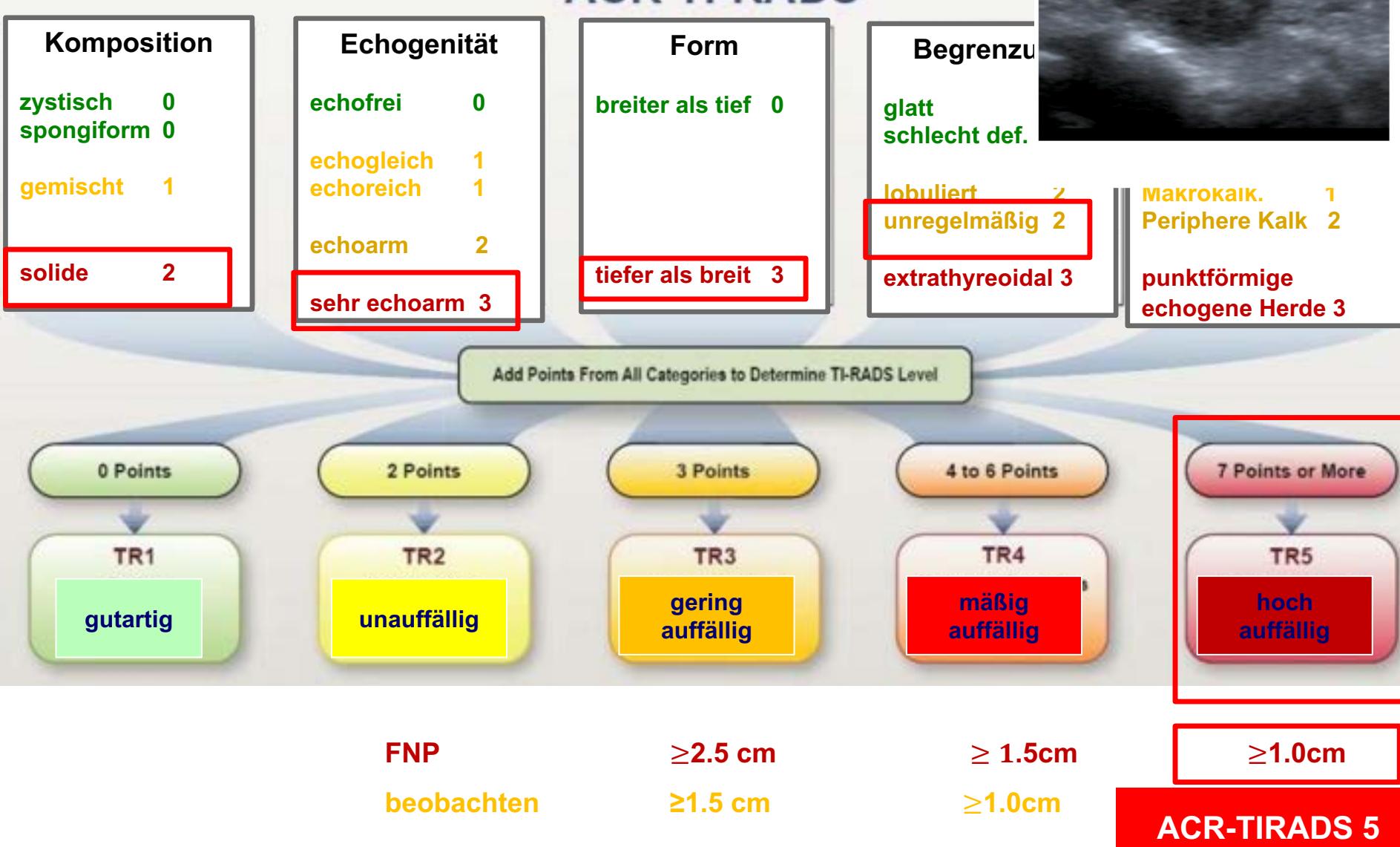


**solide
sehr echoarm
tiefer als breit
unregelmäßig**

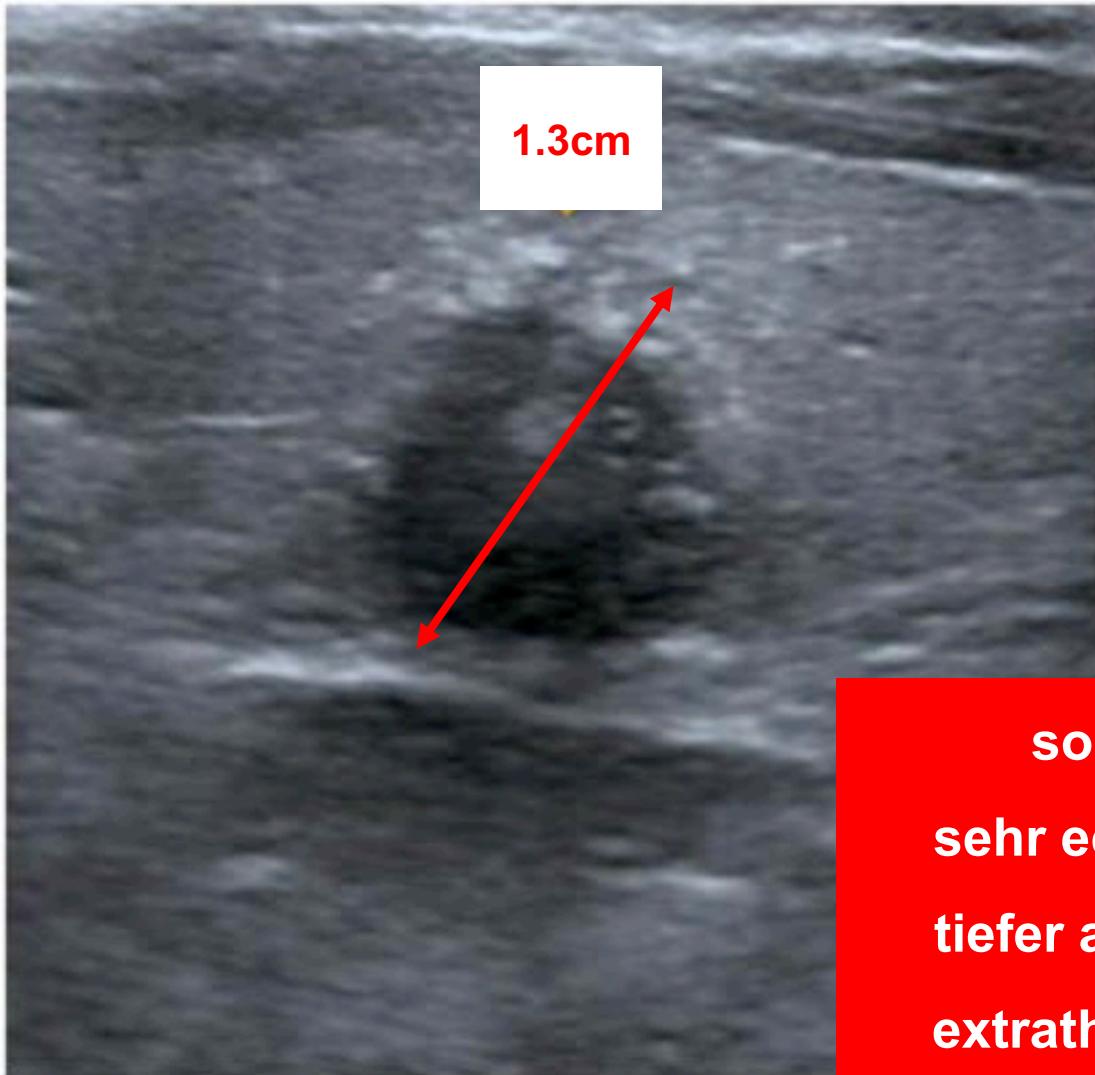
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ACR TI-RADS



LK
12mm



1.3cm

**solide
sehr echoarm
tiefer als breit
extrathyroidal
peripher Kalk**

TIRADS: Thyroid Imaging Reporting and Data System

American College of Radiology (ACR)

ACR TI-RADS

Komposition

zystisch 0
spongiform 0

gemischt 1

solide 2

Echogenität

echofrei 0
echogleich 1
echoreich 1
echoarm 2

sehr echoarm 3

Form

breiter als tief 0

tiefer als breit 3

Begrenzung

glatt 0
schlecht def. 0

lobuliert 2
unregelmäßig 2

extrathyreoidal 3

Echogene Herde

keine Kom.-S.-Art. 0
große Kom.-S.-Art. 0

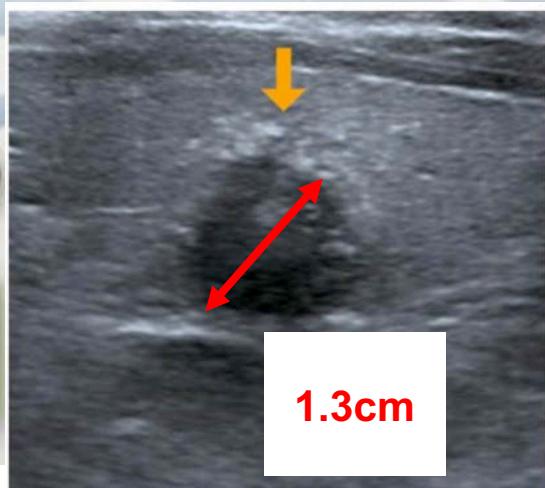
Makrokalk 1
Periphere Kalk 2

punktförmige
echogene Herde 3

0 Points

TR1

gutartig



Categories to Determine TI-RADS Level

3 Points

TR3

gering
auffällig

4 to 6 Points

TR4

mäßig
auffällig

7 Points or More

TR5

hoch
auffällig

5 cm

5 cm

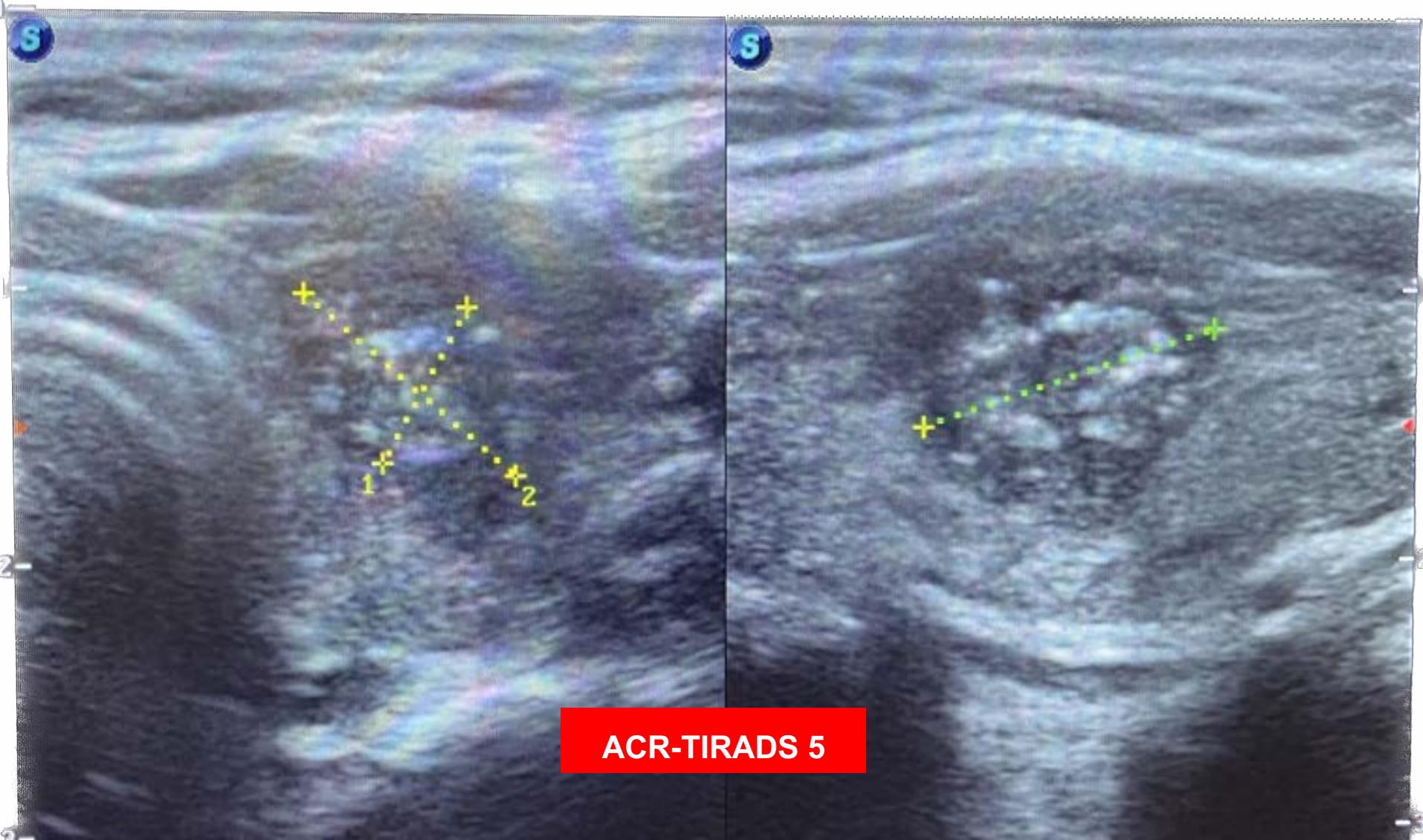
$\geq 1.5\text{cm}$

$\geq 1.0\text{cm}$

$\geq 1.0\text{cm}$

ACR-TIRADS 5

ACR-TIRADS 5: pap. Schilddrüsenkarzinom pT1b, pNo, R0, 12mm
(w, 41 Jahre)



ACR-TIRADS 5: pap. Schilddrüsenkarzinom pT1a, pNo, R0, 1mm
(w, 40 Jahre)

A grayscale ultrasound image showing a thyroid gland with a prominent, dark, irregularly shaped nodule. The nodule has internal heterogeneity and some internal vascularity, which are characteristic findings for a papillary thyroid carcinoma. The surrounding thyroid tissue appears relatively normal.

ACR-TIRADS 5

SAMSUNG

Schilddrüse
LA3-16AD
3.0cm
44Hz

[2D]

Res1

Gn 68
DR 112
FA 6
L 90%

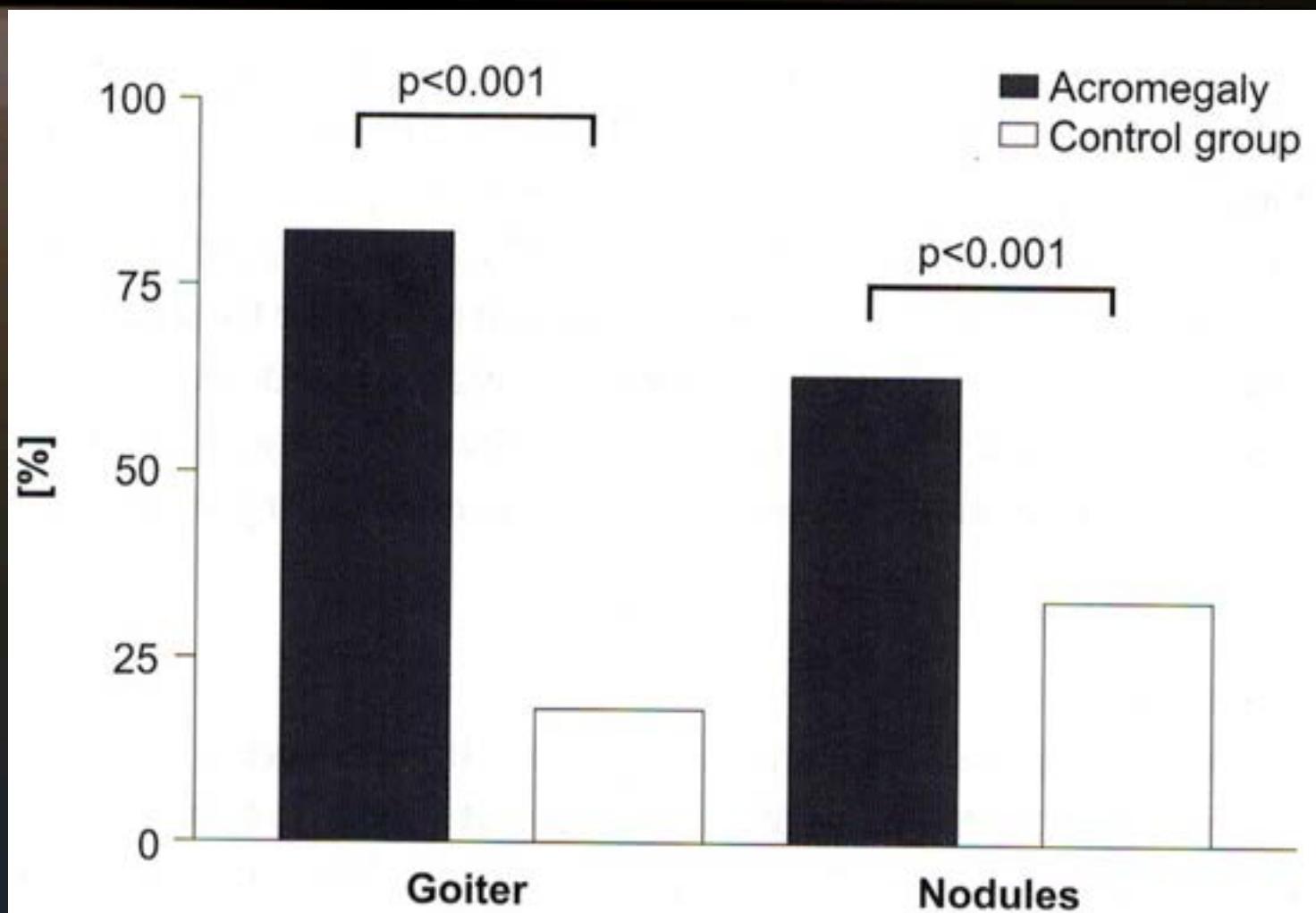


Fig. 1 Prevalence of goiter and nodules in patients with acromegaly (n = 73) and controls (n = 199).

Herrmann et al., *Exp Clin End.* 2004

ELASTOGRAPHIE

17910

Tls 0.2 MI 1.4 09-03-2023
11:22:32

Schilddrüse / LA3-16AD / 3.0cm / 22Hz

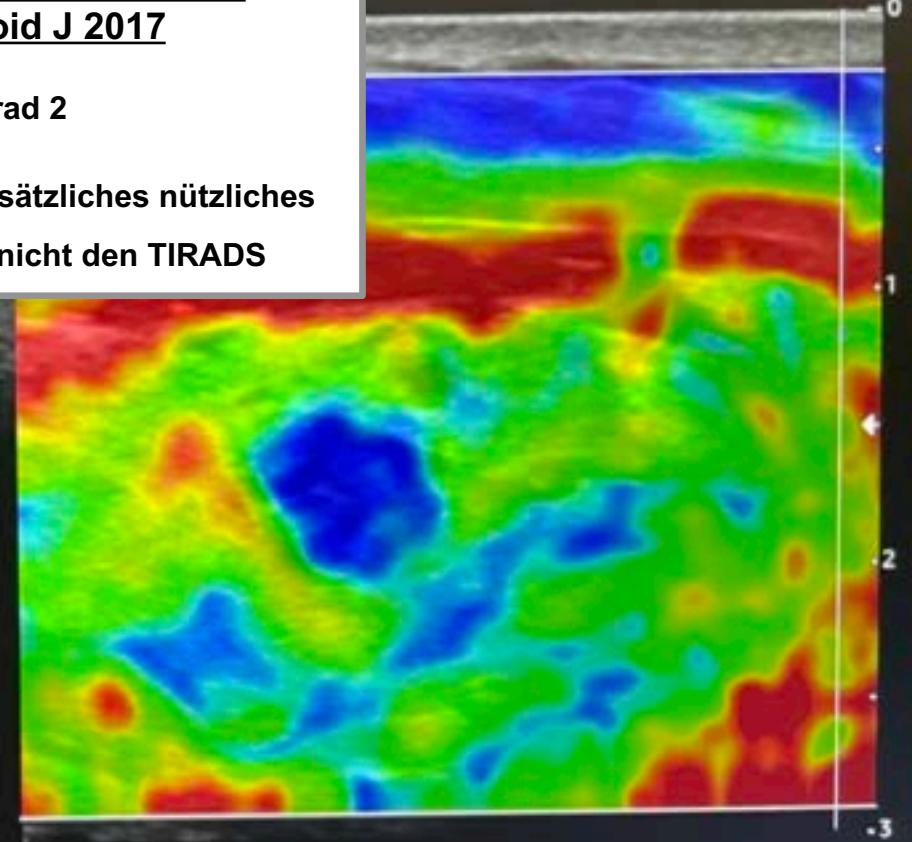
[E] Pen / Gn50

0 SAMSUNG
H5-107

European Thyroid Association
Europ Thyroid J 2017

R10: Grad 2

Elastographie ist ein zusätzliches nützliches
Tool, ersetzt jedoch nicht den TIRADS



Papilläres SD-CA 8mm

Freeze

Zeiger

BiL. speich. U3

U1 BiL. speich.

S2k-Leitlinie

Operative Therapie benigner Schilddrüsenerkrankungen

AWMF-Registernummer 088/007

Aktualisierte Version vom 05.12.2021

Operationsindikation bei der benignen Struma des Erwachsenen

Medline und Cochrane Library (1990–2016)

Eine Operation bei einer Struma mit oder ohne Knoten ist indiziert

- bei begründetem Malignitätsverdacht, insbesondere bei
 - festem, derbem, gegebenenfalls schnell wachsendem/n Knoten, der/die fixiert ist/sind
 - zervikaler Lymphadenopathie
 - sonographischer Hochrisikoläsion entsprechend Kategorie 4c und 5 TI-RADS-Klassifikation (23, Tabelle 1)
 - FNAC-Klasse verdächtig/positiv nach Schmid-Klassifikation (28, Tabelle 2) oder Klasse 4–5 nach Bethesda-Klassifikation (27)
 - FNAC-Klasse abklärungsbedürftig nach Schmid-Klassifikation (28) oder FNAC-Klasse 3 nach Bethesda-Klassifikation (27), insbesondere wenn weitere anamnestische/klinische Malignitätsindikatoren vorliegen
 - basaler Calcitonin-Erhöhung im Serum > 26 pmol/L bei Frauen und 60 pmol/L bei Männern (cave: assayabhängig)
- beim Vorliegen von Kompressionssymptomen

Eine Operation ist nicht indiziert

- bei asymptomatischer euthyreoter Knotenstruma ohne Malignitätsverdacht
- bei „szintigraphisch kaltem“ Knoten ohne weitere Malignitätsindikatoren oder andere Operationsgründe

Schilddrüsenknoten

Herne 29.11.2023



Prof. Dr. Burkhard L. Herrmann

Endokrinologie /// Diabetologie /// Osteologie /// Innere Medizin

*Innovationspark Springorum
Facharztpraxis und Labor
Springorumallee 2 - 44795 Bochum*

www.endo-bochum.de

www.osteoporose-bochum.de

TSH

0,4

4,0

(mU/I)

TABELLE 1

Typische Symptome einer Hyperthyreose

Tachykardie	Hyperreflexie	Hitzeintoleranz
Schwitzen	Tremor	Nervosität
Rasche Ermüdbarkeit	Gewichtsverlust	Appetitsteigerung
Schwäche	Diarrhoe	Dyspnoe

TABELLE 2

Typische Symptome einer Hypothyreose

Extreme Müdigkeit	schnelle Erschöpfung	depressive Verstimmung
Antriebsmangel	Konzentrationsstörungen	Kälteempfindlichkeit
Appetitlosigkeit	Gewichtszunahme	Verstopfung
Stumpfe Haare	trockene Haut	geschwollenes Gesicht