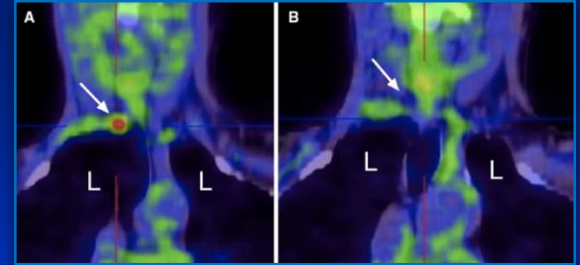
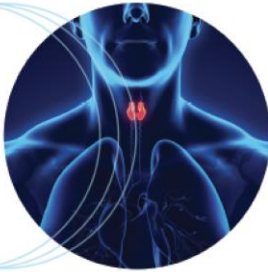


TRATTAMENTI PERCUTANEI
NELLA PATOLOGIA TIROIDEA:
stato dell'arte e prospettive future

Responsabile Scientifico:
Giovanni Mauri

Board scientifico:
Claudio Maurizio Pacella
Enrica Papini
Luigi Solbiati
Stefano Spezia



Ecografia interventistica della tiroide: dall'agoaspirato a ...

Luigi A. Solbiati

Humanitas University & Research Hospital
Rozzano (Milano)



Neck interventional procedures: 45 years of Italian success

Citodiagnostica oncologica. Testo atlante

Carlo Ravetto

Editore: Piccin-Nuova Libreria

Anno edizione: 1973



Ravetto C, Spreafico L, Colombo L. L' esame citologico con agoaspirato nella diagnosi precoce delle neoplasie tiroidee. Confronto con i dati clinici e scintigrafici. *Recenti Prog Med* 1977;63:258-74.

Usefulness of Fine-Needle Aspiration in the Diagnosis of Thyroid Carcinoma

A Retrospective Study in 37,895 Patients

Carlo Ravetto, M.D.^{1*}

Luigia Colombo, M.D.²

Massimo E. Dottorini, M.D.²

¹ Pathology Department, Ospedale di Circolo, Busto Arsizio, Italy.

² Nuclear Medicine Department, Ospedale di Circolo, Busto Arsizio, Italy.

RESULTS. The sensitivity of FNA was 91.8% and the specificity was 75.5%.

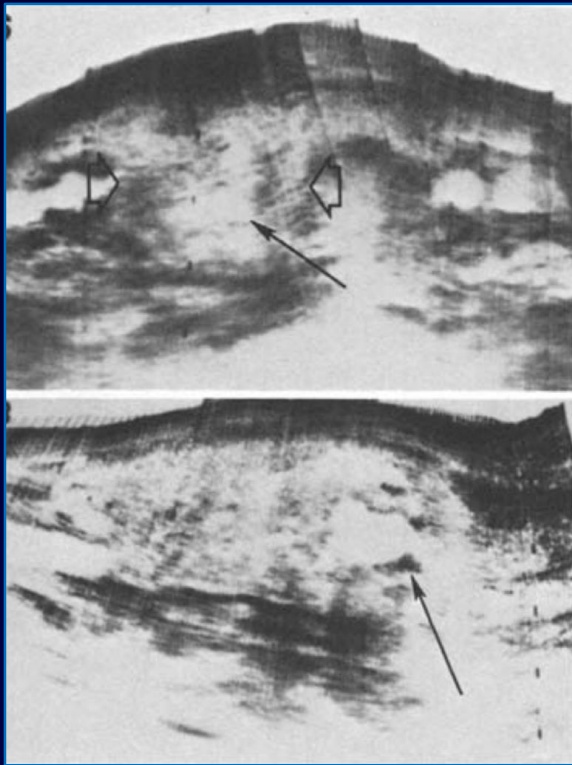
Only in the case of a cytologic diagnosis of “follicular neoplasm” was the probability of malignancy not changed significantly and histologic evaluation of the nodule was necessary.

Preoperative approach to thyroid tumours by a two-dimensional pulsed echo technique

B. Damascelli *, N. Cascinelli †, T. Livraghi *, U. Veronesi †

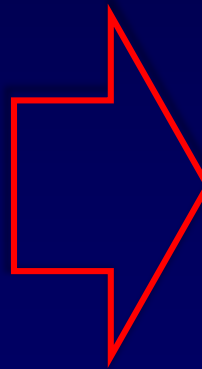
3. Crocker EF, McLaughlin AF, Kossoff G, et al: The gray scale echographic appearance of thyroid malignancy. *J Clin Ultrasound* **2**: 305–306, Dec 1974

4. Taylor KJW, Carpenter DA, Barrett JJ: Gray scale ultrasonography in the diagnosis of thyroid swellings. *J Clin Ultrasound* **2**:327–330, Dec 1974



1974

High frequency transducers allow
spatial resolution around 1.00 mm
Lesions of 3 – 5 mm can be identified



1984

- It is not possible to biopsy all nodules visible at US
- US is therefore used:
 - to identify which nodule to biopsy basing on its specific characters
 - to guide sampling into the nodule or into a specific part of the nodule

Thyroid Nodules: Is It Time to Turn Off the US Machines?¹

Radiology

J.J. Cronan, Radiology 2008; 247:602-604

THYROID NODULE \leq 10-12mm



```
graph TD; A[THYROID NODULE ≤ 10-12mm] --> B[HISTORY OF NECK RT<br/>HISTORY OF MEN<br/>SUSP. NECK ADENOPATHY]; A --> C[NEGATIVE HISTORY<br/>NO NECK ADENOPATHY]; B --> D[US - GUIDED FNAB]; C --> E[US FOLLOW - UP]
```

The flowchart starts with a rectangular box at the top containing the text 'THYROID NODULE ≤ 10-12mm'. A vertical line descends from this box and splits into two horizontal lines. The left horizontal line leads to a rectangular box containing a bulleted list: 'HISTORY OF NECK RT', 'HISTORY OF MEN', and 'SUSP. NECK ADENOPATHY'. The right horizontal line leads to a rectangular box containing a bulleted list: 'NEGATIVE HISTORY' and 'NO NECK ADENOPATHY'. From the bottom of the left box, a vertical line leads to an oval containing the text 'US - GUIDED FNAB'. From the bottom of the right box, a vertical line leads to an oval containing the text 'US FOLLOW - UP'.

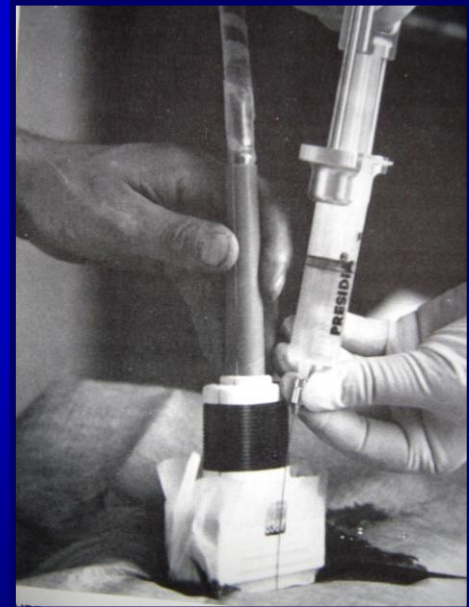
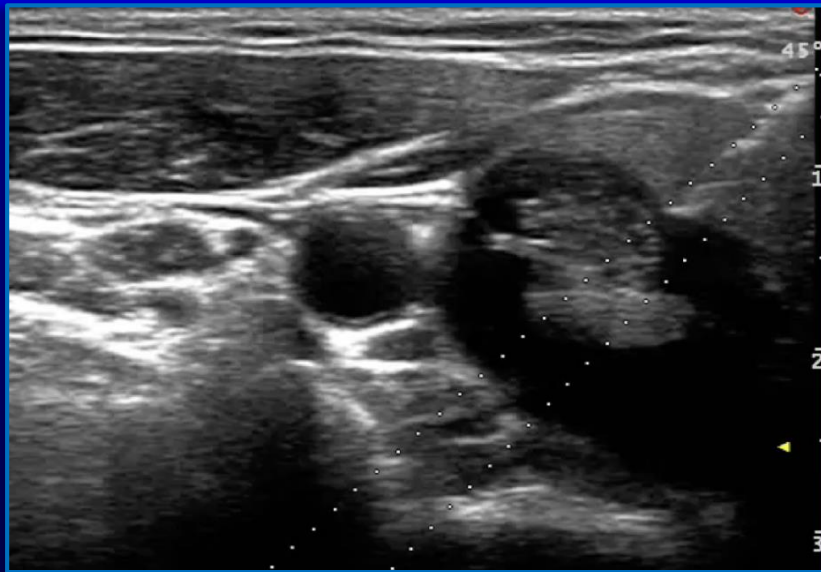
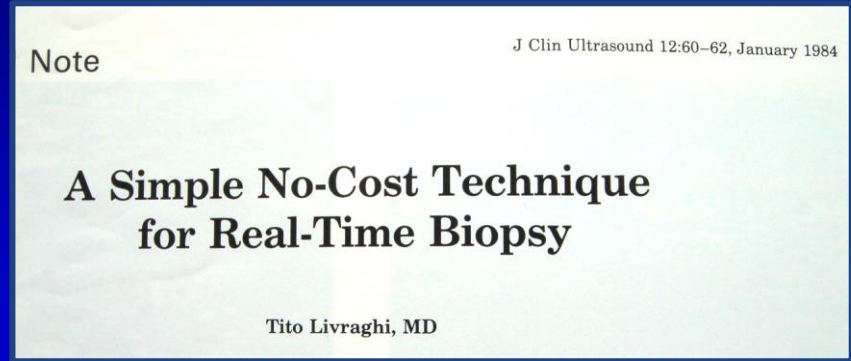
- HISTORY OF NECK RT
- HISTORY OF MEN
- SUSP. NECK ADENOPATHY

US - GUIDED FNAB

- NEGATIVE HISTORY
- NO NECK ADENOPATHY

US FOLLOW - UP

1972 - First percutaneous FNA guided by US



The Thyroid Gland with Low Uptake Lesions: Evaluation by Ultrasound¹

Radiology 1985; 155: 187-191

Luigi Solbiati
Luca Volterra
Giorgio Rizzoli
Massimo Bazzani
Paolo Busilanti
Francesco Cazzullo
Francesco Fazio
Gianmarco

TABLE 19.2 Reliability of Sonographic Features in Differentiation of Benign From Malignant Thyroid Nodules

TABLE III: Correlation of Echo Patterns with Pathologic Diagnoses in 139 Malignant Neoplasms

Echo Pattern	Papillary Neoplasms	Follicular Neoplasms	Anaplastic Neoplasms	Medullary Neoplasms	Lymphomas	Metastases
Liquid	—	—	—	—	—	—
Mixed	4 (5%)	1 (4%)	—	—	—	1 (100%)
Solid hyperechoic	3 (4%)	—	—	—	—	—
Solid isoechoic	12 (14%)	14 (52%)	2 (15%)	3 (33%)	—	—
Solid hypoechoic	66 (77%)	12 (44%)	11 (85%)	6 (67%)	4 (100%)	—
Total	85	27	13	9	4	1

Feature	PATHOLOGIC DIAGNOSIS	
	Benign	Malignant
SHAPE		
Wider than tall	+++	++
Taller than wide	+	+++
INTERNAL CONTENTS		
Purely cystic content	++++	+
Cystic with thin septa	++++	+
Mixed solid and cystic	+++	++
Comet-tail artifact	+++	+
ECHOGENICITY		
Hyperechoic	++++	+
Isoechoic	+++	++
Hypoechoic	+++	+++
Markedly hypoechoic	+	++++
HALO		
Thin halo	++++	++
Thick, incomplete halo	+	+++
Absent	+	+++
MARGIN		
Well defined	+++	++
Poorly defined	++	+++
Spiculated	+	++++
CALCIFICATION		
Eggshell calcification	+++	++
Coarse calcification	+++	+
Microcalcification	++	++++
DOPPLER		
Peripheral flow pattern	+++	++
Internal flow pattern	++	+++
SONOELASTOGRAPHY		
Patterns 1 and 2	++++	+
Patterns 3 and 4	+	+++

PART THREE: Small Parts, Carotid Arteries, and Peripheral Vessel Sonography

CHAPTER

19

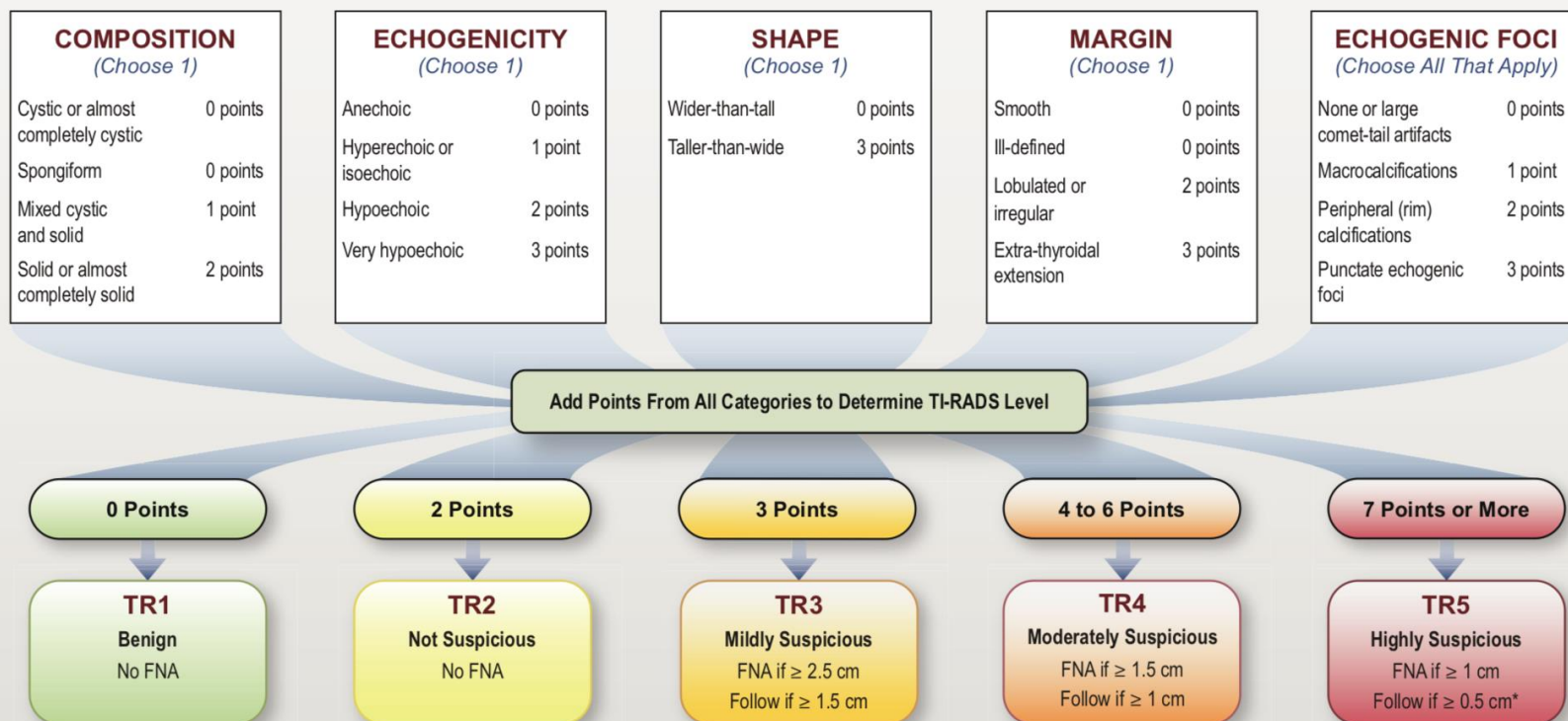
The Thyroid Gland

Luigi Solbiati, J. William Charboneau, Vito Cantisani, Carl Reading, and Giovanni

ACR Thyroid Imaging, Reporting and Data System (TI-RADS): White Paper of the ACR

Franklin
Jenny K
Michael
Ulrike
A. Thor

ACR TI-RADS



COMPOSITION	ECHOGENICITY	SHAPE	MARGIN	ECHOGENIC FOCI
<p><i>Spongiform:</i> Composed predominantly (>50%) of small cystic spaces. Do not add further points for other categories.</p> <p><i>Mixed cystic and solid:</i> Assign points for predominant solid component.</p> <p>Assign 2 points if composition cannot be determined because of calcification.</p>	<p><i>Anechoic:</i> Applies to cystic or almost completely cystic nodules.</p> <p><i>Hyperechoic/isoechoic/hypoechoic:</i> Compared to adjacent parenchyma.</p> <p><i>Very hypoechoic:</i> More hypoechoic than strap muscles.</p> <p>Assign 1 point if echogenicity cannot be determined.</p>	<p><i>Taller-than-wide:</i> Should be assessed on a transverse image with measurements parallel to sound beam for height and perpendicular to sound beam for width.</p> <p>This can usually be assessed by visual inspection.</p>	<p><i>Lobulated:</i> Protrusions into adjacent tissue.</p> <p><i>Irregular:</i> Jagged, spiculated, or sharp angles.</p> <p><i>Extrathyroidal extension:</i> Obvious invasion = malignancy.</p> <p>Assign 0 points if margin cannot be determined.</p>	<p><i>Large comet-tail artifacts:</i> V-shaped, >1 mm, in cystic components.</p> <p><i>Macrocalcifications:</i> Cause acoustic shadowing.</p> <p><i>Peripheral:</i> Complete or incomplete along margin.</p> <p><i>Punctate echogenic foci:</i> May have small comet-tail artifacts.</p>

1983

[Parathyroid tumors detected by fine-needle aspiration biopsy under ultrasonic guidance.](#)

Solbiati L, Montali G, Croce F, Bellotti E, Giangrande A, Ravetto C.

Radiology. 1983 Sep;148(3):793-7.

[Percutaneous ethanol injection of parathyroid tumors under US guidance: treatment for secondary hyperparathyroidism.](#)

Solbiati L, Giangrande A, De Pra L, Bellotti E, Cantù P, Ravetto C.

Radiology. 1985 Jun;155(3):607-10.

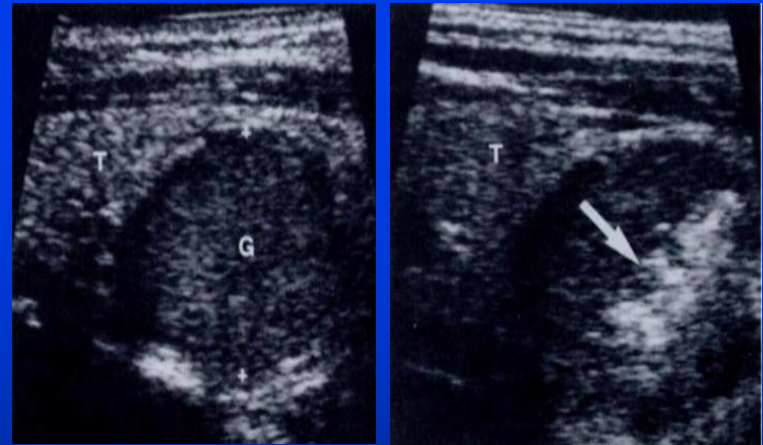
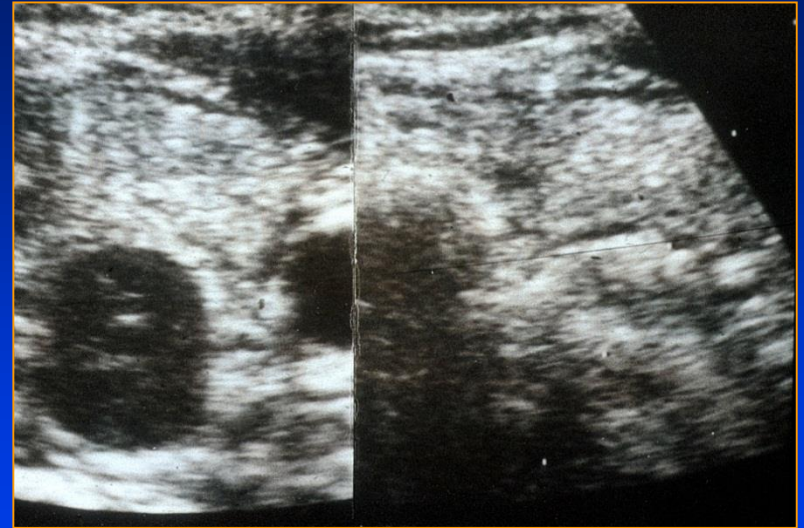
2013

INTERVENTIONAL RADIOLOGY

Luigi Solbiati, M.D.
Alberto Giangrande, M.D.
Luigi De Pra, M.D.
Elena Bellotti, M.D.
Paola Cantù, M.D.
Carlo Ravetto, M.D.

Percutaneous Ethanol Injection of Parathyroid Tumors under US Guidance: Treatment for Secondary Hyperparathyroidism¹

Radiology 1985; 155: 607-610



February 1982

**This was probably the first percutaneous
“ablation” of a solid tumor in the history of
Medicine.**

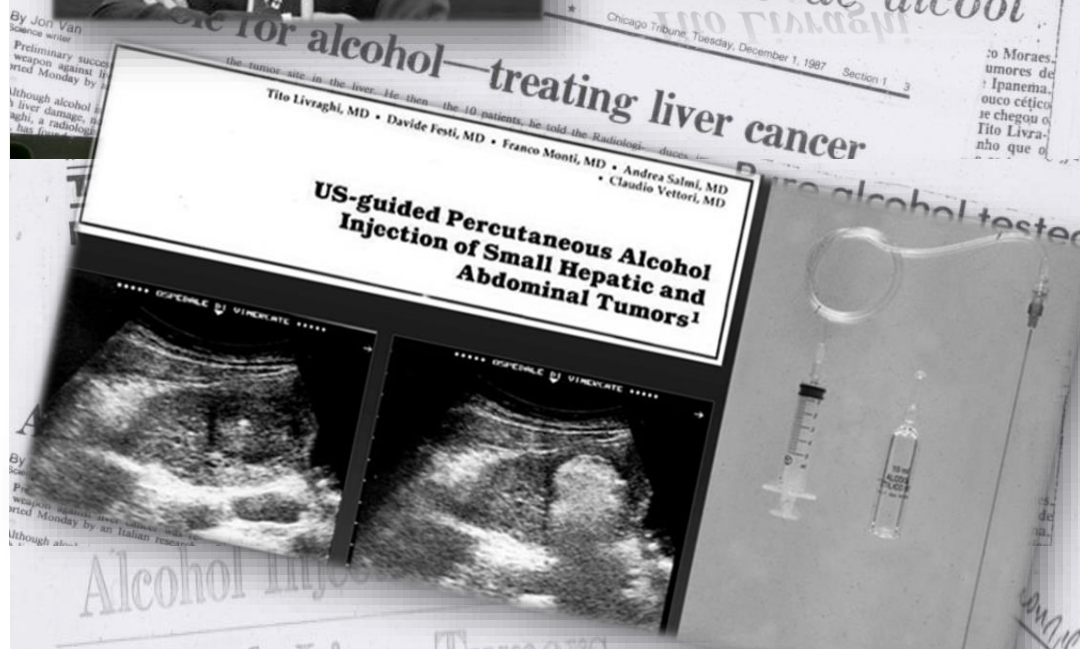


Finding New Role for ALCOHOL



Tito Livraghi

Italy



My initial studies, before PEI, were made injecting chemotherapeutic agents according to the tumoral histotype.

I started to use ethanol after the Solbiati's study for the treatment of parathyroid hyperplasia.

Tito Livraghi, MD • Alessandra Paracchi, MD • Carlo Ferrari, MD • Mario Bergonzi, MD •
Gilberto Garavaglia, MD • Paolo Raineri, MD • Claudio Vettori, MD

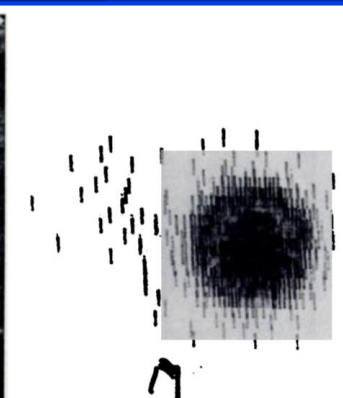
Treatment of Autonomous Thyroid Nodules with Percutaneous Ethanol Injection: Preliminary Results

Work in Progress¹

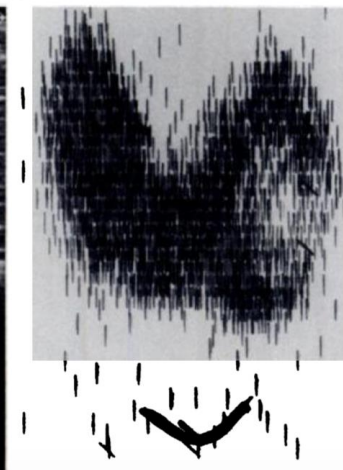
Radiology 1990; 175:827-829



a.



b.



ALCOOLIZZAZIONE di NODULI IPERFUNZIONANTI

- *RISULTATI* -

- “complete cure” in 68-100 % dei noduli pre-tossici
 in 50-89 % dei noduli tossici
- “partial cure” in 10-39% dei noduli tossici e pre-tossici

Livraghi T, 1990 - Monzani F, 1992 - Papini E, 1993 - Livraghi T, 1994
Paracchi A, 1992 - Martino E, 1992 - Mazzeo S, 1993 - Ozdemir H, 1994

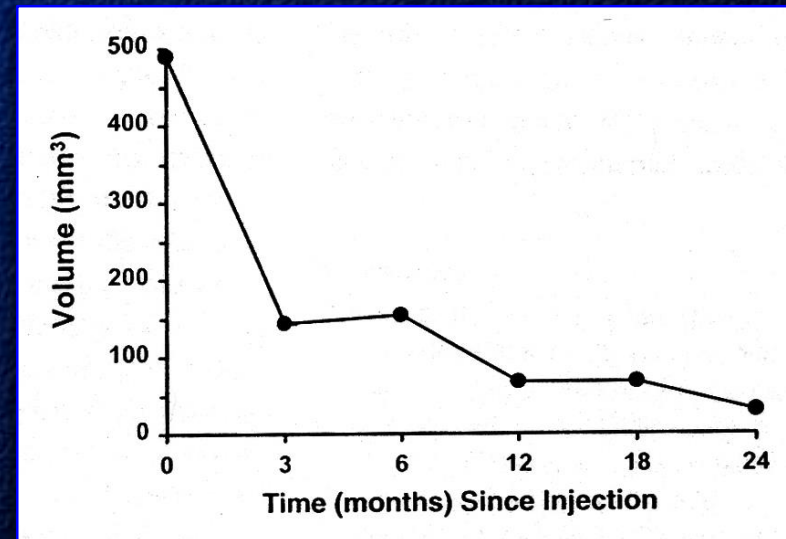
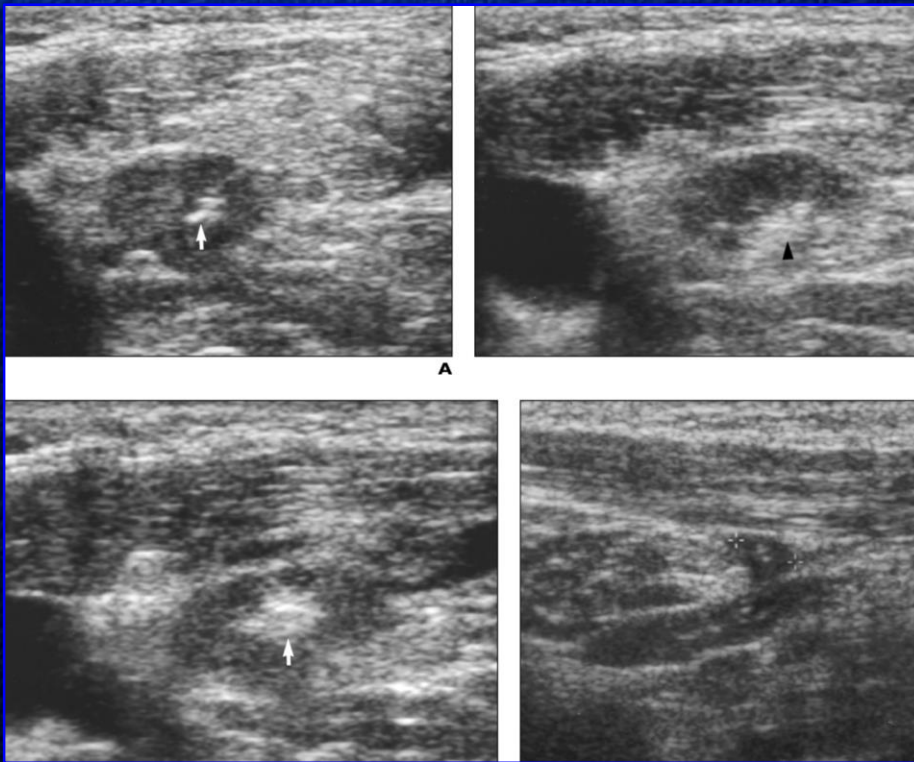
Nella serie più ampia (101 pz. - Livraghi T, 1994) con follow-up di 6-48 mesi:

- *cura completa in 50% dei noduli tossici e 68% dei pre tossici*
- *significativa riduzione di volume del nodulo nel 73%*
- *4-8 sessioni di trattamento/nodulo*

Percutaneous Ethanol Injection for Treatment of Cervical Lymph Node Metastases in Patients with Papillary Thyroid Carcinoma

B. D. Lewis¹
I. D. Hay²
J. W. Charboneau¹
B. McIver²
C. C. Reading¹
J. R. Goellner³

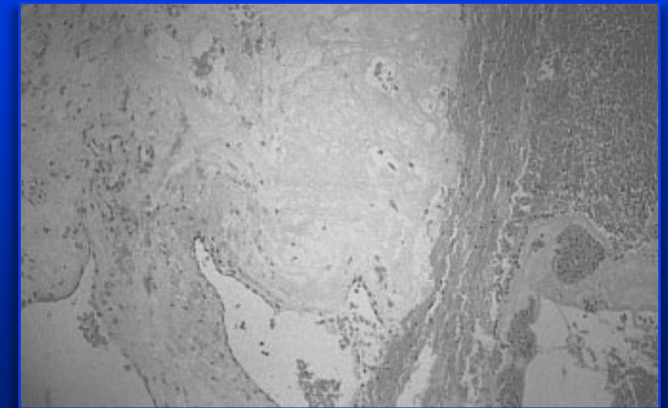
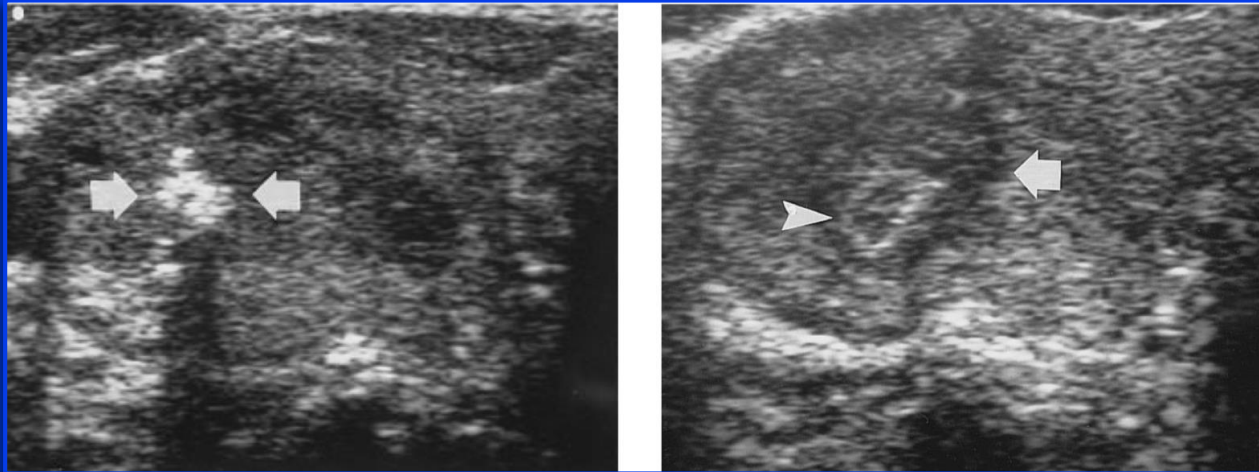
*AJR*2002;178:699-704



Thyroid Tissue: US-guided Percutaneous Interstitial Laser Ablation—A Feasibility Study¹

Claudio M. Pacella, MD
Giancarlo Bizzarri, MD
Rinaldo Guglielmi, MD
Vincenzo Anelli, MD
Antonio Bianchini, MD
Anna Crescenzi, MD
Sara Pacella, MD
Enrico Papini, MD

Radiology 2000; 217:673–677



Benign solitary solid cold thyroid nodules : US-guided interstitial Ultrasound-guided laser thermal ablation in the

Thyroid tissue : US-guided percutaneous laser thermal ablation. Pacella CM, Bizzarri G, Spiezia S, et al.
Radiology 2004; 232: 272-280.

25 pts. at poor surgical risk, treated for cold nodules (8), hyperfunctioning (16) or anaplastic carcinoma (1).

1-4 21G spinal needles, 3-5W laser.

2 cases of mild dysphonia, resolved at 48 hours and 2 months.
Improvement of local compression symptoms in 12/14.

TSH detectable in 5/16 (31%) hyperfunctioning.

32 mL of necrosis in the anaplastic treated.

Mean volume reduction of 3.3 ± 2.8 mL (62% \pm 21.4%) in hyperfunctioning and 7.7 ± 7.5 mL (63% \pm 13.8) in cold nodules.

Thyroid. 2006 Apr;16(4):361-7.

Radiofrequency ablation of benign cold thyroid nodules: initial clinical experience.

Kim YS¹, Rhim H, Tae K, Park DW, Kim ST.

J Am Geriatr Soc. 2007 Sep;55(9):1478-9.

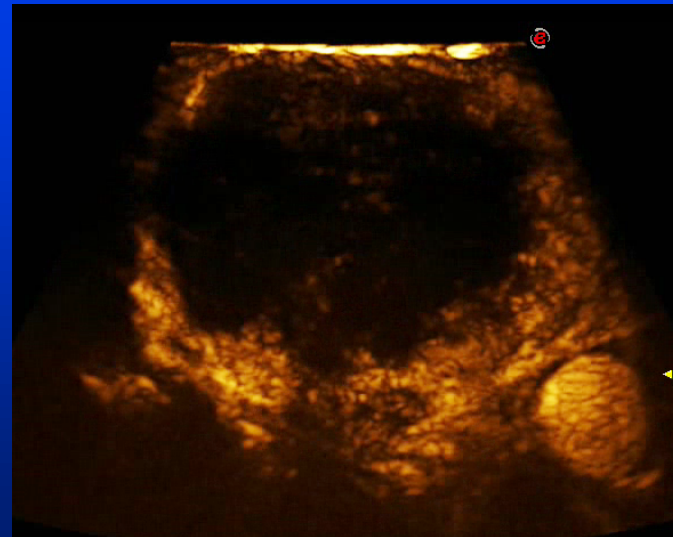
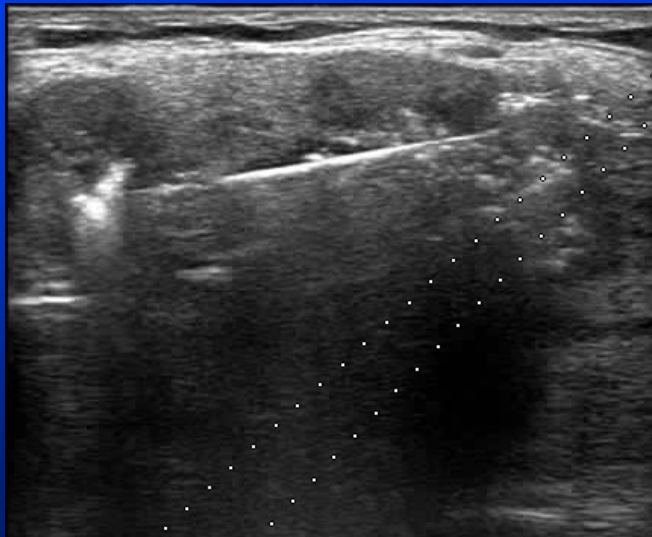
Efficacy and safety of radiofrequency thermal ablation in the treatment of thyroid nodules with pressure symptoms in elderly patients.

Spiezia S, Garberoglio R, Di Somma C, Deandrea M, Basso E, Limone PP, Milone F, Ramundo V, Macchia PE, Biondi B, Lombardi G, Colao A, Faggiano A.

Eur Radiol. 2008 Jun;18(6):1244-50. doi: 10.1007/s00330-008-0880-6. Epub 2008 Feb 20.

Radiofrequency ablation of benign thyroid nodules: safety and imaging follow-up in 236 patients.

Jeong WK¹, Baek JH, Rhim H, Kim YS, Kwak MS, Jeong HJ, Lee D.





Before RF ablation



6-month



12-month



18-month

Complications Encountered in the Treatment of Benign Thyroid Nodules with US-guided Radiofrequency Ablation: A Multicenter Study¹

Jung Hwan Baek, MD
Jeong Hyun Lee, MD
Jin Yong Sung, MD
Jae-Ik Bae, MD
Kyung Tae Kim, MD
Jungsuk Sim, MD
Seon Mi Baek, MD
Young-sun Kim, MD
Jung Hee Shin, MD
Jeong Seon Park, MD
Dong Wook Kim, MD
Ji-hoon Kim, MD
Eun-Kyung Kim, MD
So Lyung Jung, MD
Dong Gyu Na, MD

For the Korean Society of Thyroid Radiology

Radiology: Volume 262: Number 1—January 2012

Review Article

<http://dx.doi.org/10.3348/kjr.2012.13.2.117>
pISSN 1229-6929 · eISSN 2005-8330
Korean J Radiol 2012;13(2):117-125

Korean Journal of Radiology

KJR

Radiofrequency Ablation of Benign Thyroid Nodules and Recurrent Thyroid Cancers: Consensus Statement and Recommendations

Dong Gyu Na, MD², Jeong Hyun Lee, MD¹, So Lyung Jung, MD³, Ji-hoon Kim, MD⁴, Jin Yong Sung, MD⁵,
Jung Hee Shin, MD⁶, Eun-Kyung Kim, MD⁷, Joon Hyung Lee, MD⁸, Dong Wook Kim, MD⁹,
Jeong Seon Park, MD¹⁰, Kyu Sun Kim, MD⁵, Seon Mi Baek, MD¹¹, Younghen Lee, MD¹², Semin Chong, MD¹³,
Jung Suk Sim, MD¹⁴, Jung Yin Huh, MD¹⁵, Jae-Ik Bae, MD¹⁶, Kyung Tae Kim, MD¹⁷,
Song Yee Han, MD¹⁸, Min Young Bae, MD¹⁹, Yoon Suk Kim, MD²⁰, Jung Hwan Baek, MD¹;
for Korean Society of Thyroid Radiology (KSTTR), Korean Society of Radiology

1983



2013

[Parathyroid tumors detected by fine-needle aspiration biopsy under ultrasonic guidance.](#)

Solbiati L, Montali G, Croce F, Bellotti E, Giangrande A, Ravetto C.
Radiology. 1983 Sep;148(3):793-7.

[Percutaneous ethanol injection of parathyroid tumors under US guidance: treatment for secondary hyperparathyroidism.](#)

Solbiati L, Giangrande A, De Pra L, Bellotti E, Cantù P, Ravetto C.
Radiology. 1985 Jun;155(3):607-10.

[Thyroid tissue: US-guided percutaneous interstitial laser ablation-a feasibility study.](#)

Pacella CM, Bizzarri G, Guglielmi R, Anelli V, Bianchini A, Crescenzi A, Pacella S, Papini E.
Radiology. 2000 Dec;217(3):673-7.

[Long-term effectiveness of ultrasound-guided laser ablation of hyperfunctioning parathyroid adenomas: present and future perspectives.](#)

Andrioli M, Riganti F, Pacella CM, Valcavi R.
AJR Am J Roentgenol. 2012 Nov;199(5):1164-8. doi: 10.2214/AJR.11.8442.

[Image-guided percutaneous ablation therapies for local recurrences of thyroid tumors.](#)

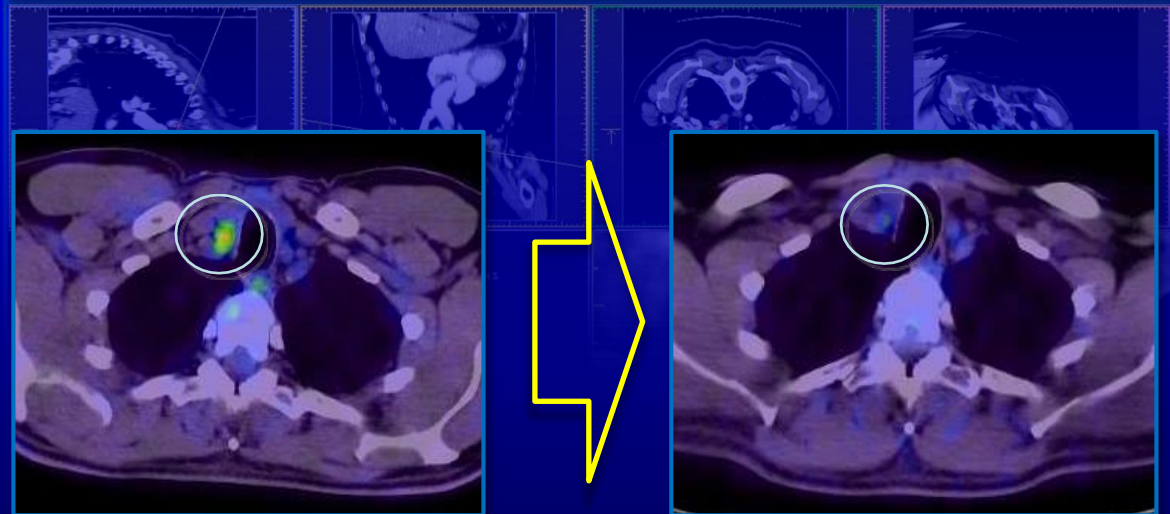
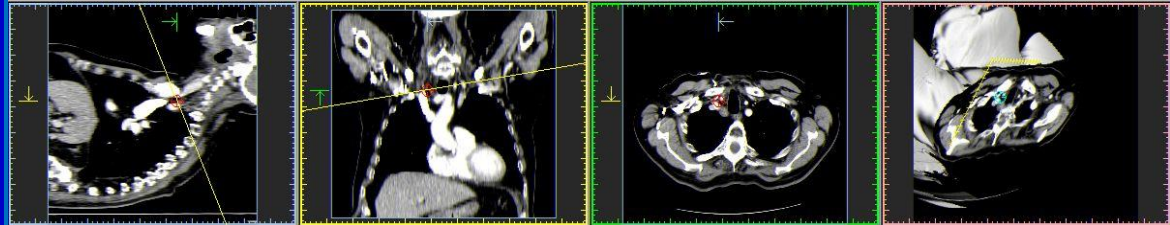
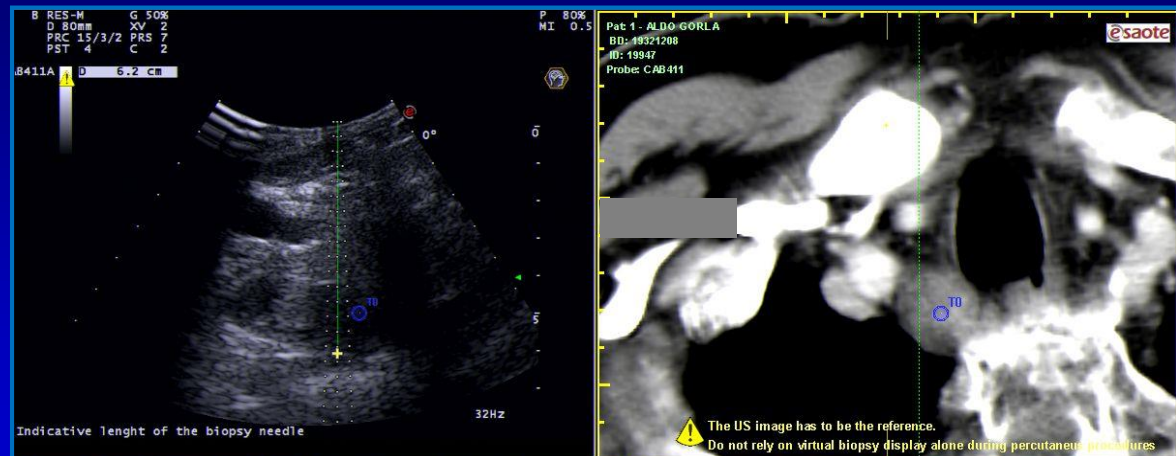
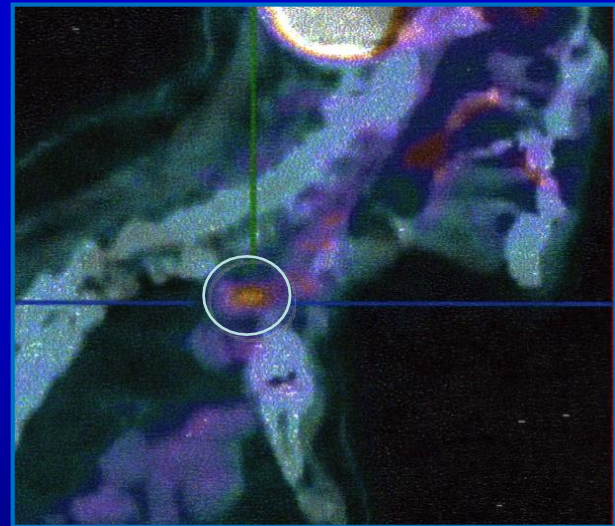
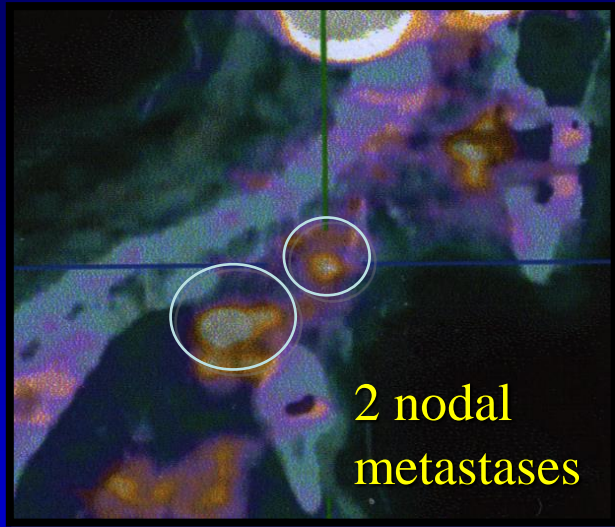
Pacella CM, Papini E.
J Endocrinol Invest. 2013 Jan;36(1):61-70.

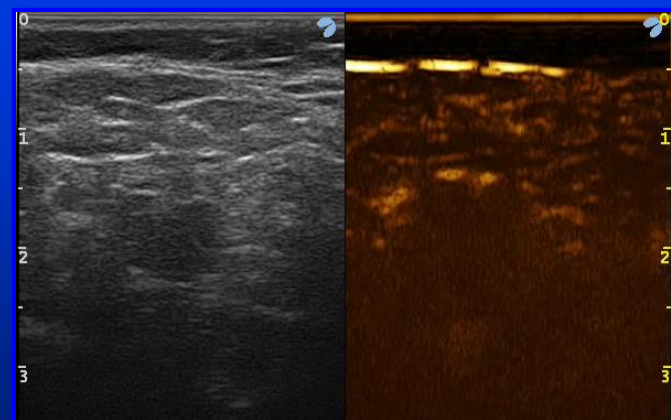
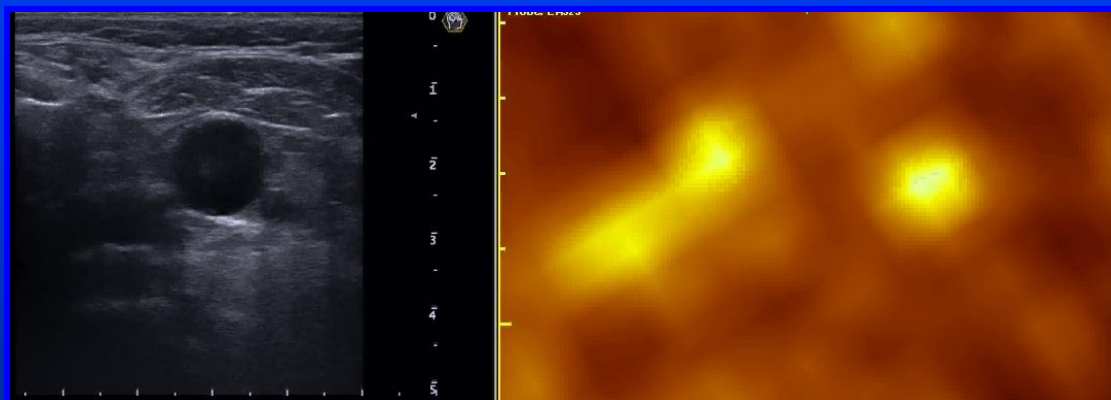
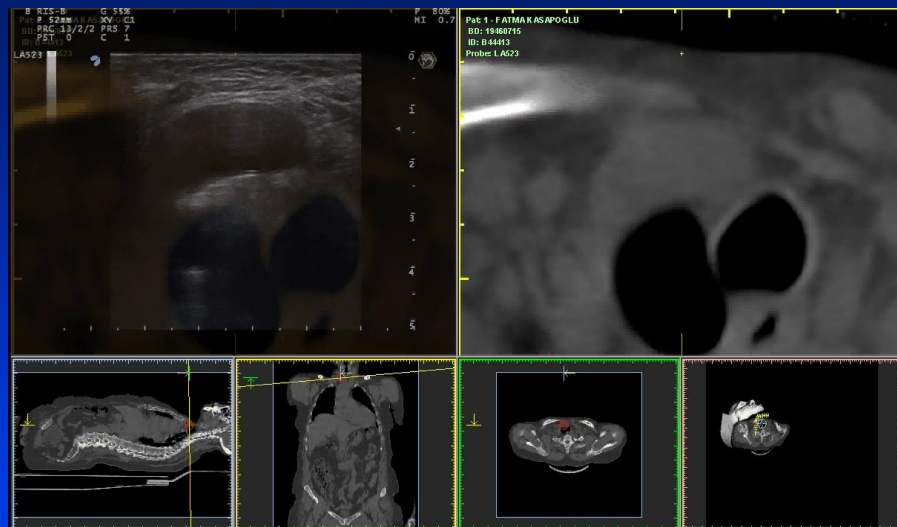
[Percutaneous Laser Ablation of Metastatic Lymph Nodes in the Neck From Papillary Thyroid Carcinoma: Preliminary Results.](#)

Mauri G, Cova L, Tondolo T, Ierace T, Baroli A, Di Mauro E, Pacella CM, Goldberg SN, Solbiati L.
J Clin Endocrinol Metab. 2013 May 10. [Epub ahead of print]

J Clin Endocrinol Metab. 2013 May 10. [Epub ahead of print]

Mauri G, Cova L, Tondolo T, Ierace T, Baroli A, Di Mauro E, Pacella CM, Goldberg SN, Solbiati L.





ORIGINAL ARTICLE – HEAD AND NECK ONCOLOGY

Inoperable Symptomatic Recurrent Thyroid Cancers: Preliminary Result of Radiofrequency Ablation

Ko Woon Park, MD¹, Jung Hee Shin, MD, PhD¹, Boo-Kyung Han, MD, PhD¹, Eun Young Ko, MD, PhD¹,
and Jae Hoon Chung, MD, PhD²

Efficacy and Safety of Radiofrequency Ablation for Treatment of Locally Recurrent Thyroid Cancers Smaller than 2 cm¹

Ji-hoon Kim, MD, PhD
Won Sang Yoo, MD
Young Joo Park, MD, PhD
Do Joon Park, MD, PhD
Tae Jin Yun, MD
Seung Hong Choi, MD, PhD
Chul-Ho Sohn, MD, PhD
Kyu Eun Lee, MD, PhD
Myung-Whun Sung, MD, PhD
Yeo-Kyu Youn, MD, PhD
Kwang Hyun Kim, MD, PhD
Bo Youn Cho, MD, PhD

, Sungkyunkwan University School of
Medicine, Department of Endocrinology and Metabolism, Samsung Medical

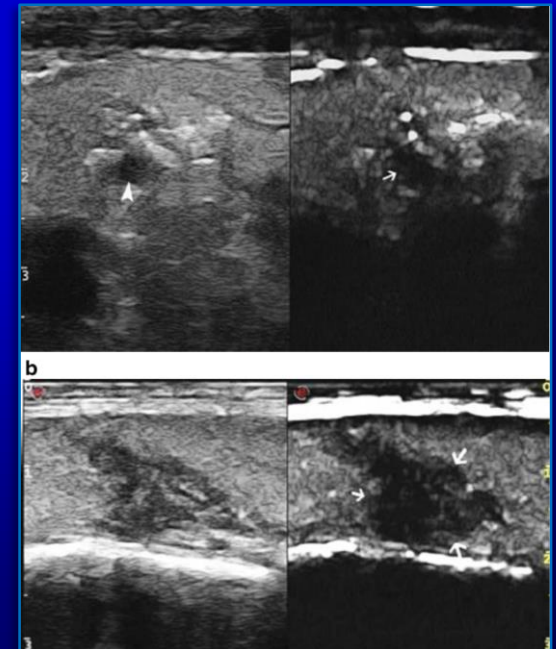
Eur Radiol (2017) 27:2934–2940
DOI 10.1007/s00330-016-4610-1



ULTRASOUND

Ultrasound-guided percutaneous laser ablation of unifocal T1N0M0 papillary thyroid microcarcinoma: Preliminary results

Wei Zhou¹ • Shan Jiang¹ • Weiwei Zhan¹ • Jianqiao Zhou¹ • Shangyan Xu¹ • Lu Zhang¹



Future perspectives

[Int J Hyperthermia](#). 2016 Nov 22:1-2. [Epub ahead of print]

Percutaneous ablation holds the potential to substitute for surgery as first choice treatment for symptomatic benign thyroid nodules.

[Mauri G](#)¹, [Sconfienza LM](#)².

[Int J Hyperthermia](#). 2016 Sep 20:1-11. [Epub ahead of print]

Radiofrequency ablation of low-risk small papillary thyroidcarcinoma: preliminary results for patients ineligible for surgery.

[Kim JH](#)¹, [Baek JH](#)², [Sung JY](#)³, [Min HS](#)^{4,5}, [Kim KW](#)⁶, [Hah JH](#)⁷, [Park DJ](#)⁸, [Kim KH](#)⁹, [Cho BY](#)¹⁰, [Na DG](#)¹¹.

Microwave ablation induces a lower systemic stress response in patients than open surgery for treatment of benign thyroid nodules

January 2018 · International Journal of Hyperthermia

DOI · 10.1080/02656736.2018.1427286

Jing Yan · Tihong Qiu · Jing Lu · [Show all 5 authors](#) · Yinghong Yang

Lang and Wu *Journal of Therapeutic Ultrasound* (2017) 5:11
DOI 10.1186/s40349-017-0091-1

Journal of
Therapeutic Ultrasound

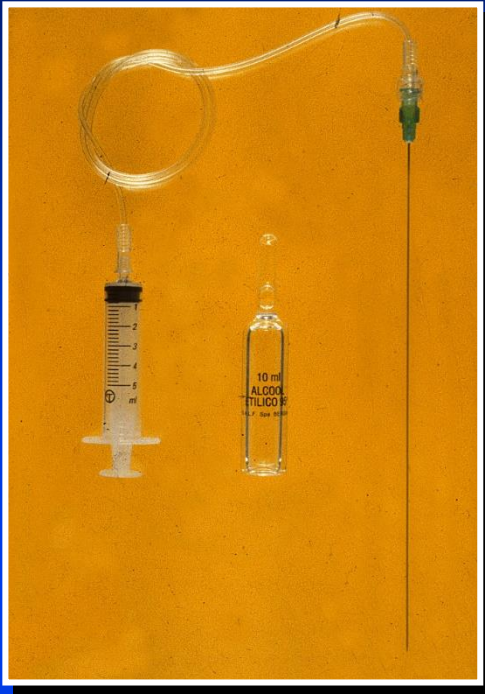
REVIEW

Open Access

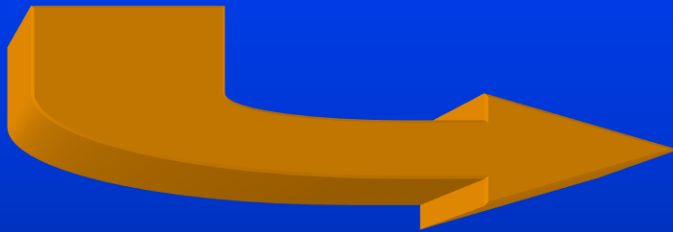
High intensity focused ultrasound (HIFU) ablation of benign thyroid nodules – a systematic review



Brian Hung-Hin Lang^{1,2*} and Arnold L. H. Wu¹



30 years ago



??

- Prediction is very difficultespecially about the future



Niels Bohr, 1885-1962

A scenic landscape photograph featuring a range of mountains in the background, their peaks illuminated by a warm, golden light from a low sun. The foreground consists of a calm body of water that perfectly reflects the mountains and the sky. The sky is a clear, pale blue. The overall mood is peaceful and serene.

Thank you