



Roma, 9-12 novembre 2017

Thyroid Nodule Ultrasound & US-assisted Procedures



ITALIAN CHAPTER



Laser Ablation & Other US-guided Techniques

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Conflitti di interesse



Ai sensi dell'art. 3.3 sul conflitto di interessi, pag 17 del Regolamento Applicativo Stato-Regioni del 5/11/2009, dichiaro che negli ultimi 2 anni **non** ho avuto rapporti diretti di finanziamento con soggetti portatori di interessi commerciali in campo sanitario.



In 1992 we became aware of the limits of PEI for the treatment of solid thyroid nodules.

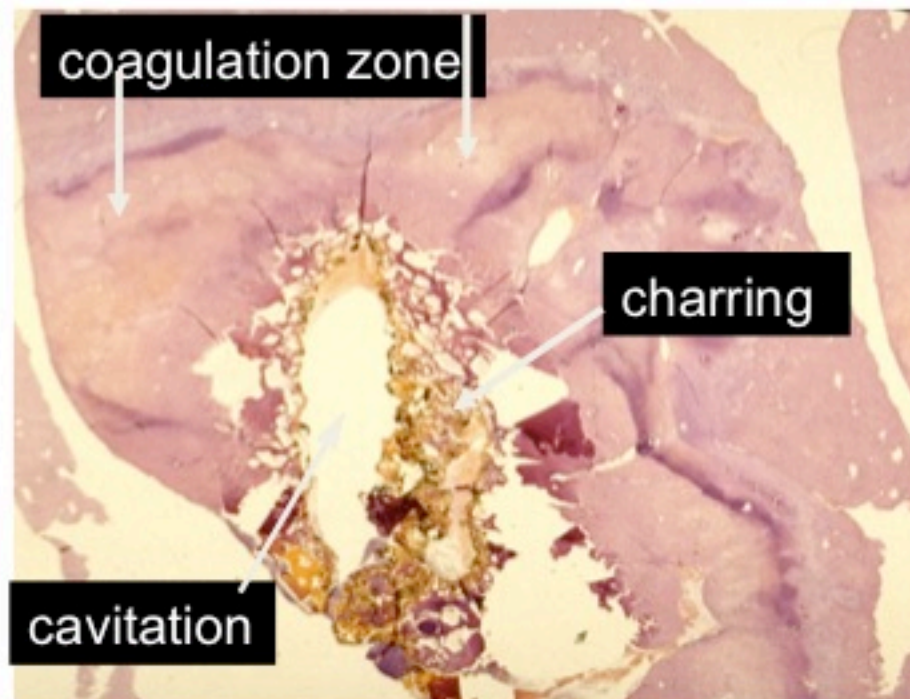


1993: Animal models

Ultrasound radiology

Ultrasound-guided percutaneous laser ablation of liver tissue in a rabbit model

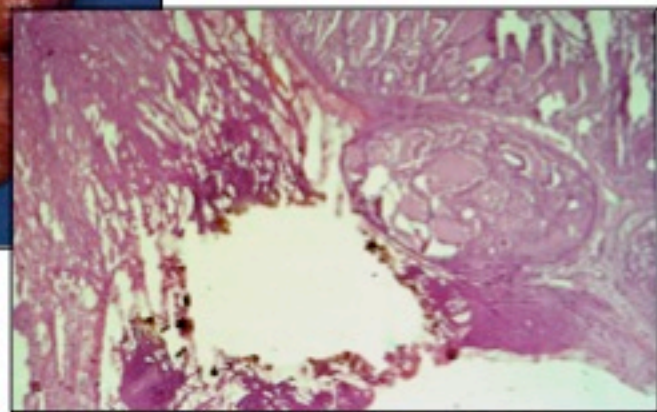
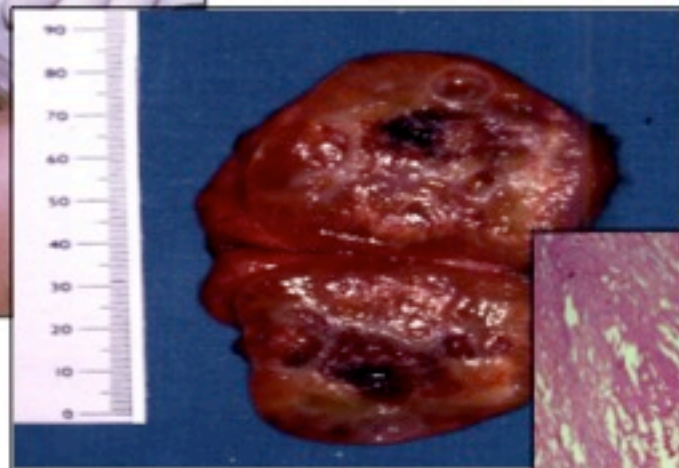
- New Zealand rabbits
- Nd:YAG laser coupled to a 600 nm quartz fibreoptic guide
- fibre and thermocouple placed in the lumen of two Chiba needles (18 G) and inserted into the liver 10 mm apart under US guidance
- laser fired for 5 minutes at 1, 3 and 5 W power
- rabbits survived for the full extent of the study.



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Feasibility:
Radiology 2000

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



Histologic examination: central cavitation area, rim of carbonization, coagulative necrosis, peripheral edema.



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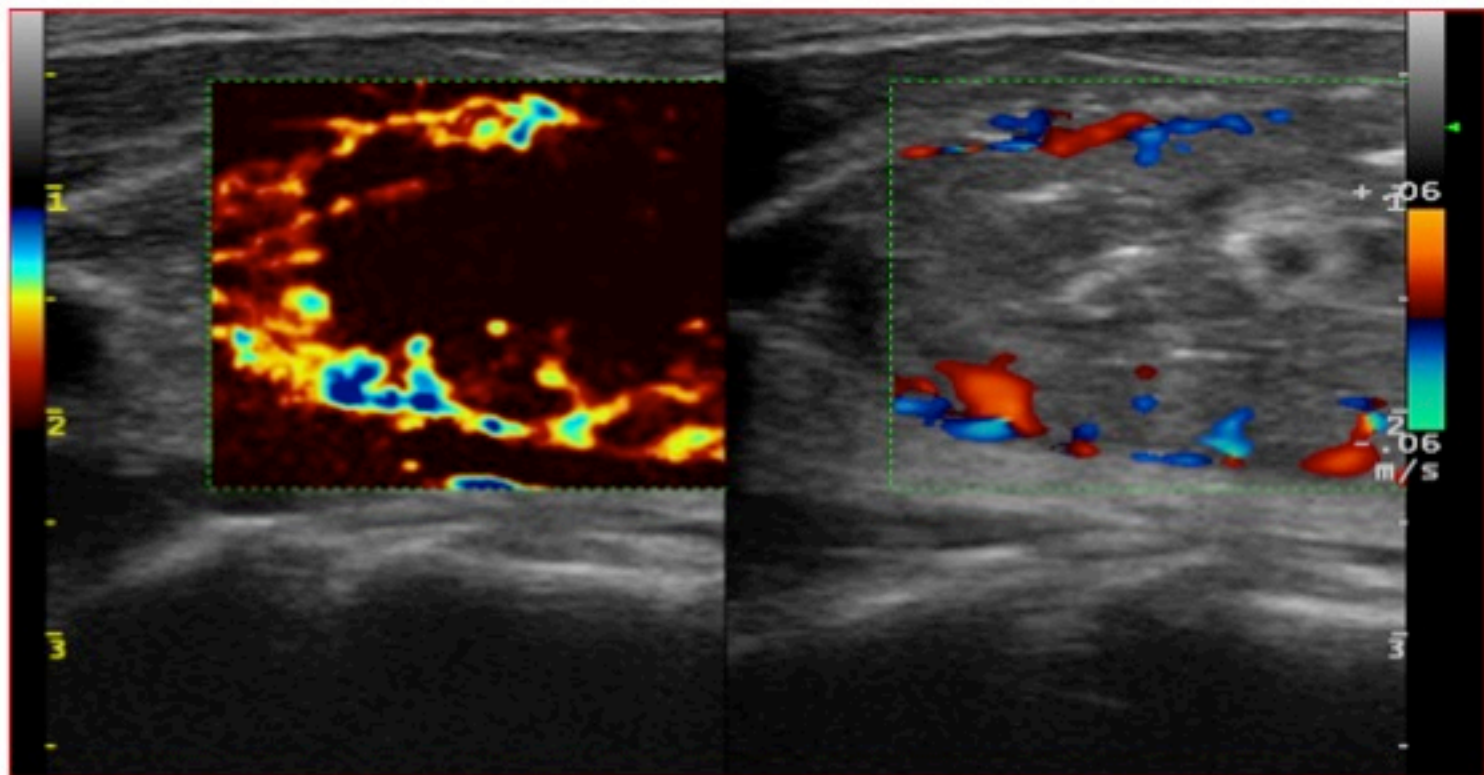


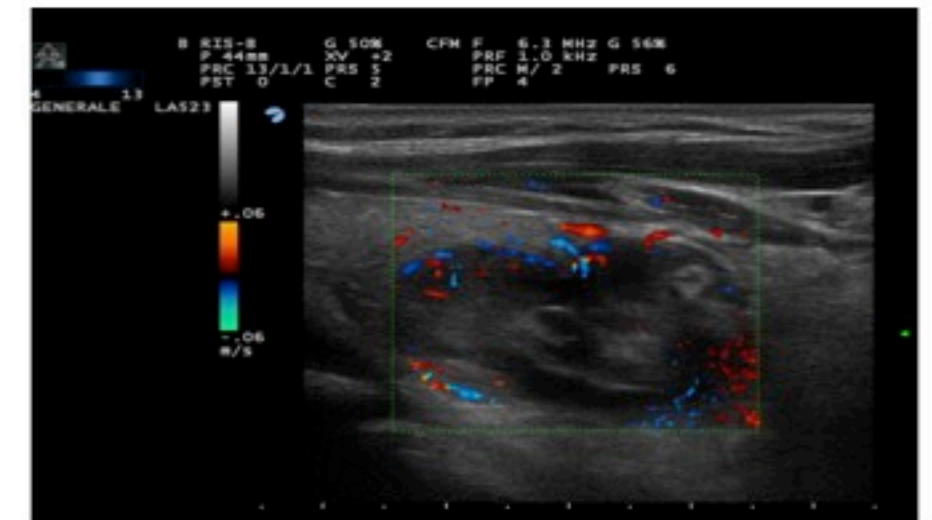
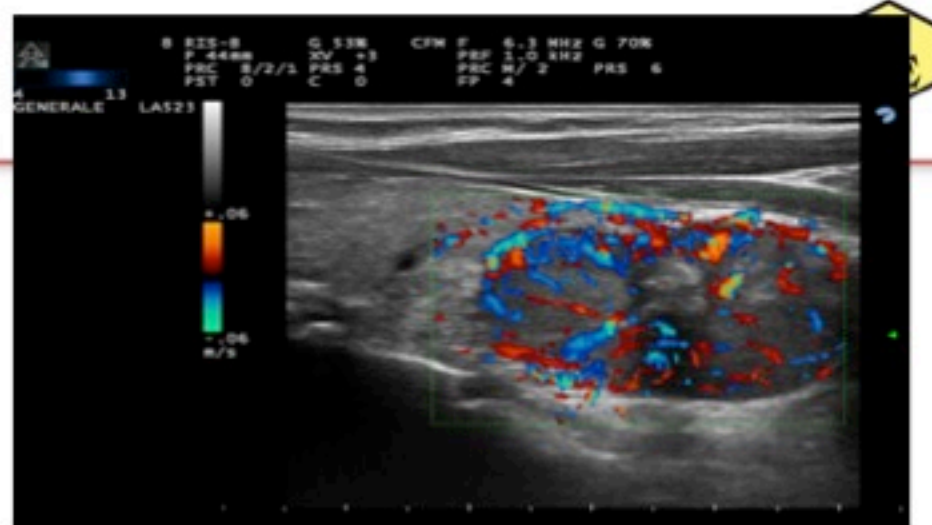
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Microvascular and power-Doppler assessment after laser ablation of thyroid nodules



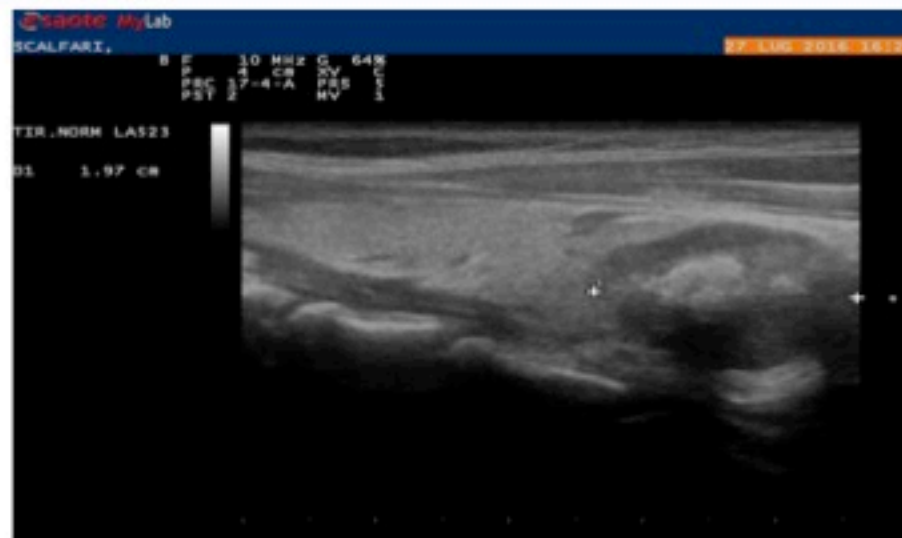
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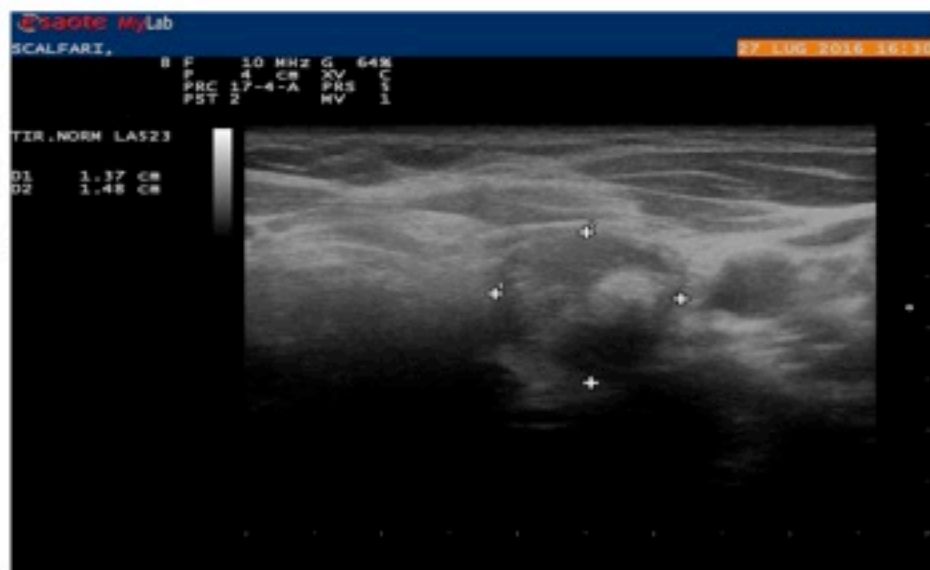




US Control 6 months after PLA



From 6.8 to 2.6 mL



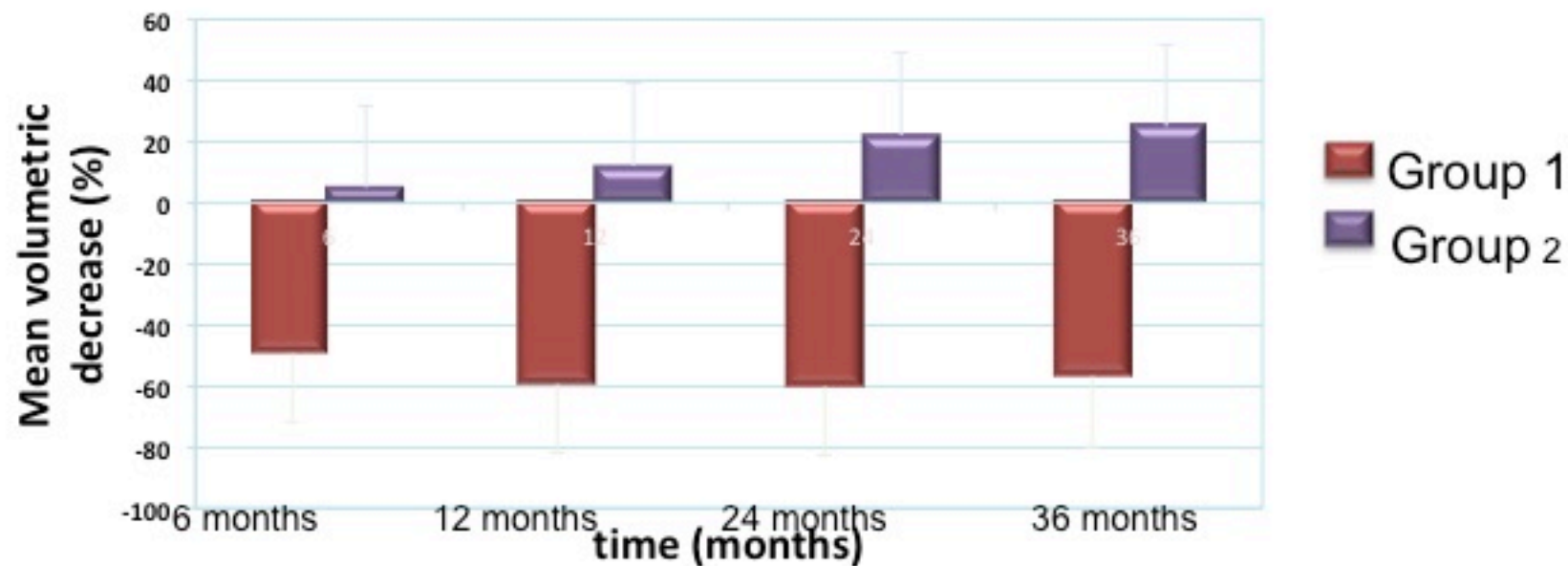
2014: Italian Multicenter Study on Laser Ablation of Cold Thyroid Nodules. Three-Year Results



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Mean volume changes (%) at 6, 12, 24, and 36 months respect to baseline values in Group 1 (active treatment, 101 cases) and Group 2 (99 controls)





Outcomes and Risk Factors for Complications of Laser Ablation for Thyroid Nodules. A Multicenter Study on 1531 Patients

Pacella CM*, Mauri G°, Achille G^{oo}, Barbaro D^{ooo}, Bizzarri G*, De Feo P**, Di Stasio E⁺, Esposito R, Gambelunghe G**, Misichi I***, Raggiunti B, Rago T, Patelli GL^o, D'este S^o, Vitti P, and Papini E***

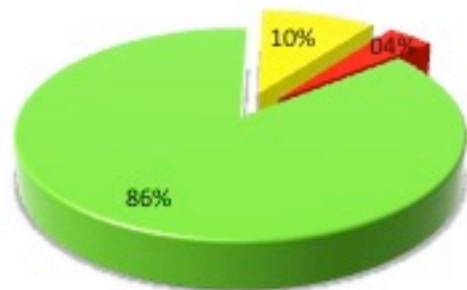
2015: Large scale trials

Results: Total number of treatments was 1,837; 1,280 (83%) of nodules had a single LAT session. Mean nodule volume decreased from 27 ± 24 mL at baseline to 8 ± 8 mL 12 months after treatment ($p < 0.001$). Mean nodule volume reduction was $72 \pm 11\%$ (range, 48–96%). This figure was significantly greater in mixed nodules ($79 \pm 7\%$; range, 70–92%) because they were drained immediately before laser illumination. Symptoms improved from 49% to 10% of cases ($p < 0.001$) and evidence of cosmetic signs from 86% to 8% of cases ($p < 0.001$). Seventeen complications (0.9%) were registered. Eight (0.5%) patients experienced transitory voice changes that completely resolved at ENT examination within 2–84 days. Nine (0.5%) minor complications were reported. No changes in thyroid function or autoimmunity were observed.

- **mean nodule volume decrease: 70% (multiple treatments)**
 - **complication rate: 0.5%**



Discomfort Induced By Laser Treatment



- repeatable without any problem
- repeatable if absolutely necessary
- not repeatable

PAIN WAS REPORTED AS MILD AND SHORT-TERM BY 86% OF TREATED PATIENTS

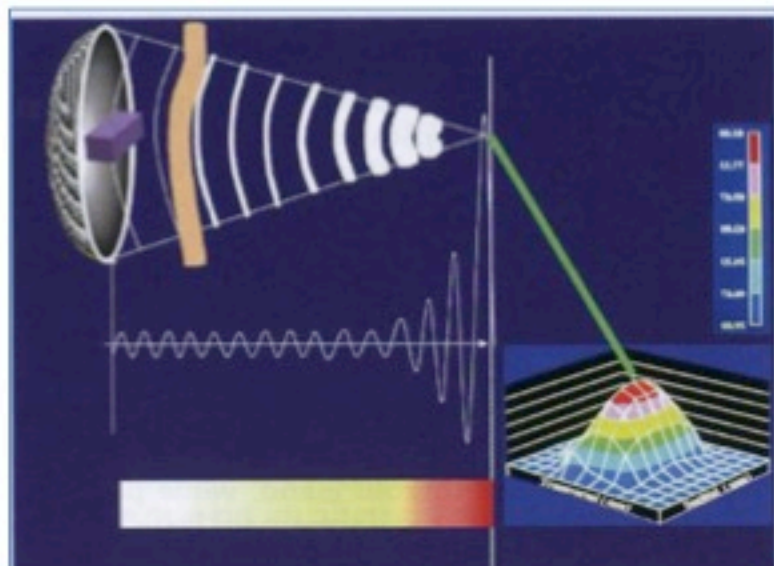


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High-intensity focused ultrasound



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External generation of ultrasound waves that are focused on a target internal tissue. Energy propagates without damage through the skin to the inner focal point with thermal ablation.

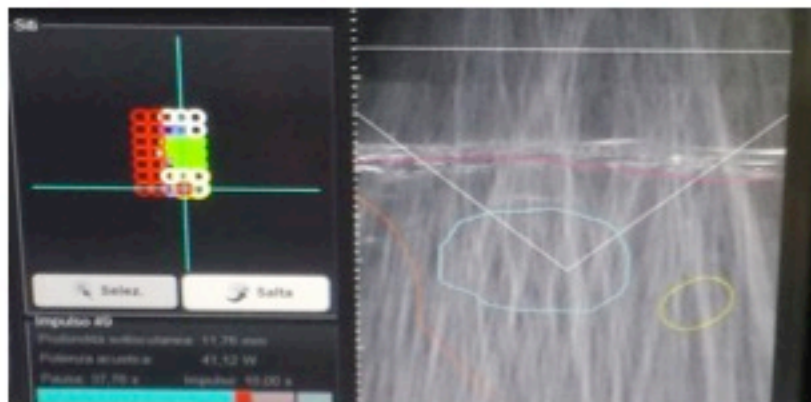
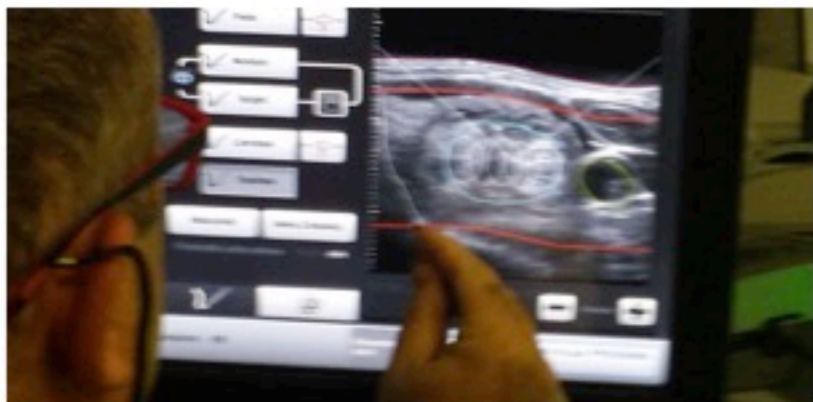
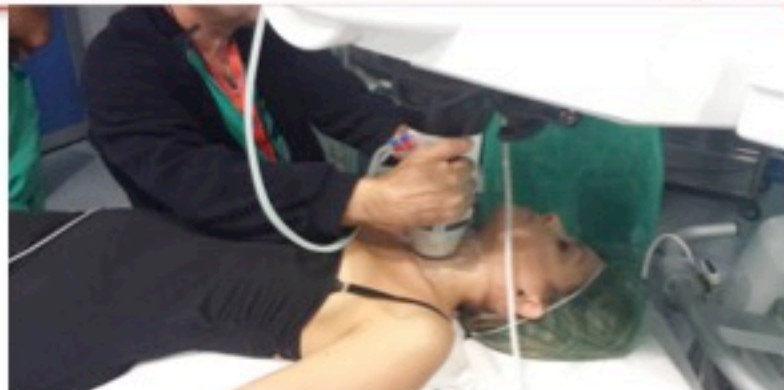


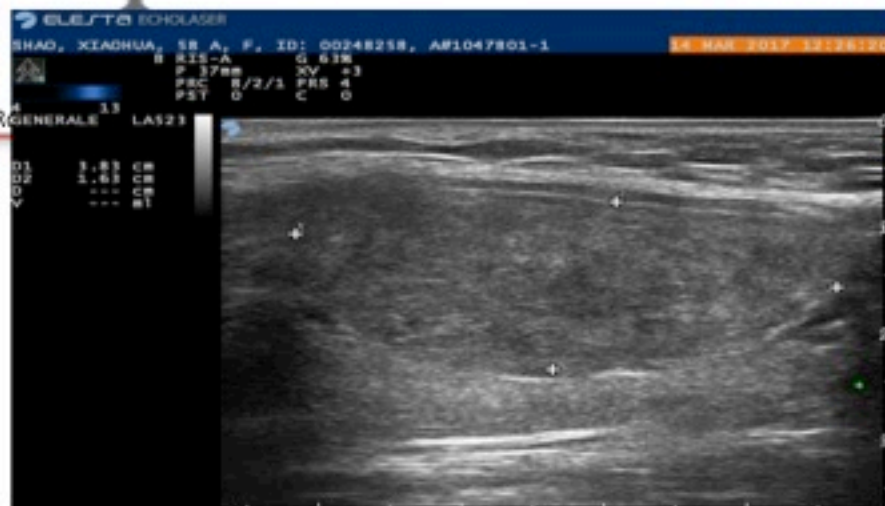
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HIFU Procedure



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US pattern 24 hours after
HIFU treatment





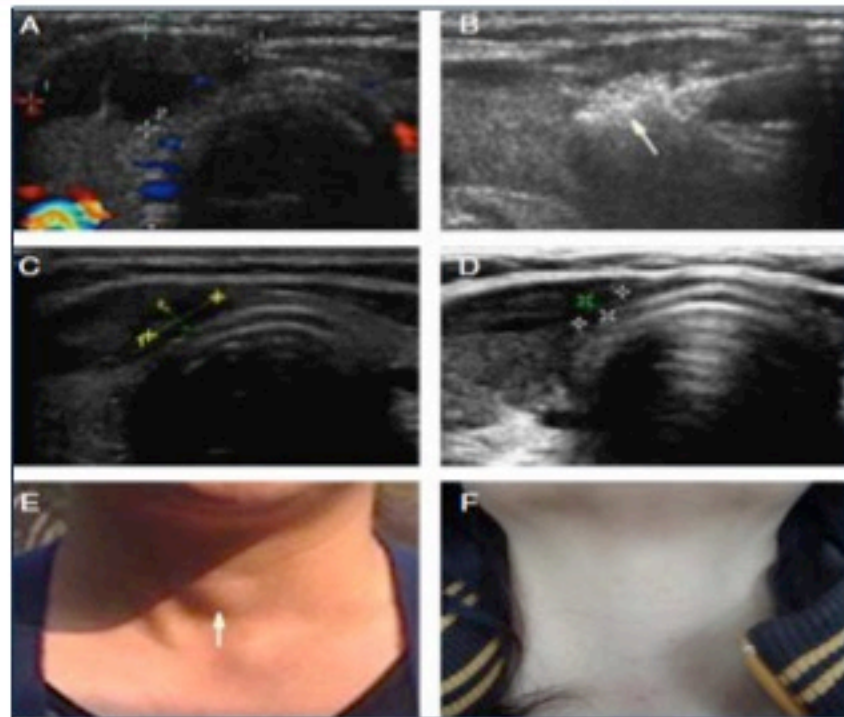
CLINICAL STUDY

Ultrasound-guided percutaneous microwave ablation of benign thyroid nodules: experimental and clinical studies

Bing Feng, Ping Liang, Zhigang Cheng, Xiaoling Yu, Jie Yu, Zhiyu Han and Fangyi Liu



- Local anesthesia and conscious sedation
- Internally-cooled 16 G MW antenna
- 12 month US follow-up
- Nodule volume decrease: 46% vs. baseline
- Several major and minor side-effects.





Which are the advantages (and limits) of these techniques?



Cost-benefit Ratio of Thermal Ablation



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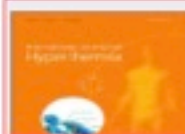
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Advantages:

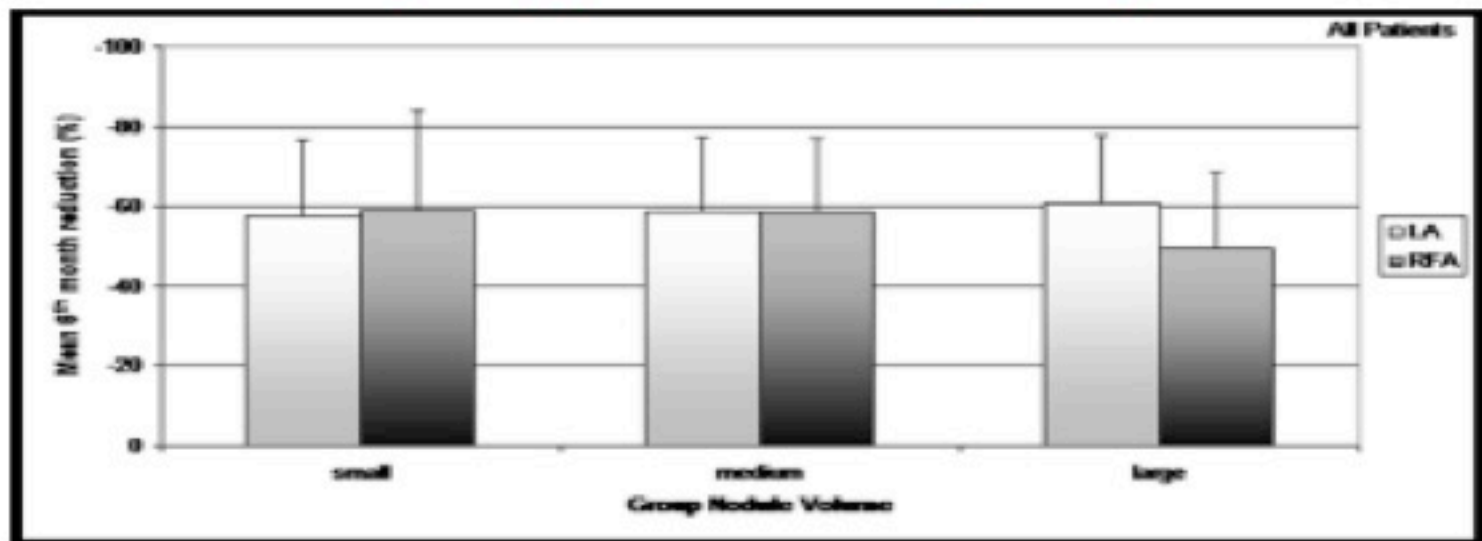
- Reduction of nodule volume and symptoms
- No cosmetic damage
- Tolerable local pain
- No late hypothyroidism
- No heavy technology
- No general anesthesia
- Outpatient clinics (about 30 minutes)

Disadvantages:

- Persistence of the lesion: US & cytologic follow-up
- Well-trained operator
- Complications rare but potentially severe
- Not cost-effective in large goiter (prefer surgery)
- Regrowth after 3 years in about 5% of cases.



A Comparison of Laser with Radiofrequency Ablation for the Treatment of Benign Thyroid Nodules A Propensity Score Matching Analysis

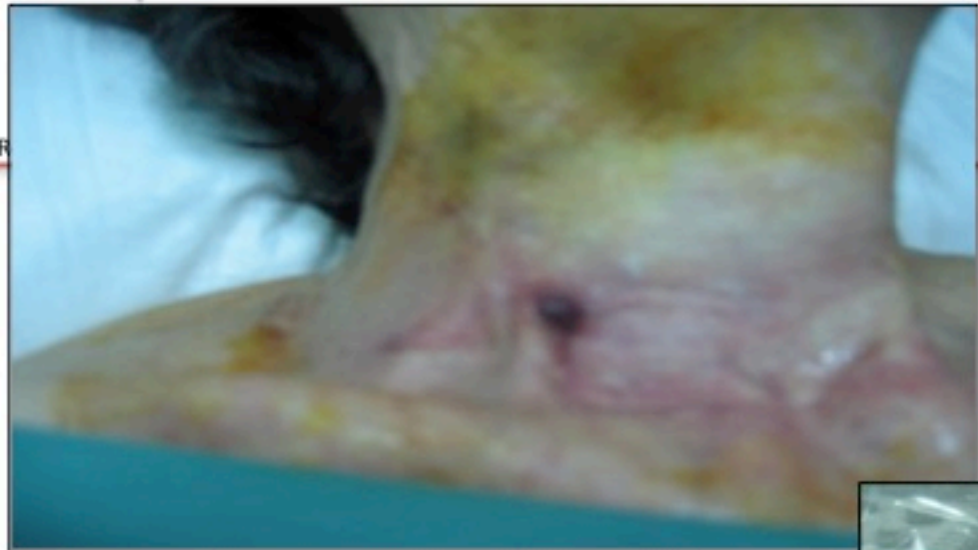


Efficacy, Cost, Indications & Limits of MITs

	PEI	PLA	RFA	MW	HIFU
Efficacy	+++	+++	+++	+++?	+
Safety	++++	+++	++	- ?	+++
Cost	+	++	+++	++?	++++
Training	+	++	+++	+++?	++
Indication	Cystic & complex lesions	Solid nodules & Cancer Recurrences	Solid nodules & Cancer Recurrences	Solid nodules?	Selected small size nodules



Can we do something
(besides surgery) for
repeat cervical
recurrences of PTC?



Papillary thyroid carcinoma treated with total thyroidectomy, neck dissection (pT3N1bM1) and radioiodine.

Disease persistence with dysphagia and dysphonia.

No ^{131}I uptake after a third therapeutic dose (150 mCi).





Suspicious Cervical Lymph Nodes Detected after Thyroidectomy for Papillary Thyroid Cancer Usually Remain Stable Over Years in Properly Selected Patients

J Clin Endocrinol Metab, August 2012,

E. Robenshtok, S. Fish, A. Bach, Jose M. Dominguez, A. Shaha, and R. M. Tuttle

Outcome measures	Data
Duration of follow-up (yr) [median (range)]	3.5 (1–13)
Number of US during follow-up [median (range)]	6 (2–16)
Change in size	
≥ 3 mm	33/166 (20%)
≥ 5 mm ²	15/166 (9%)
Salvage surgery	22/166 (13%)
Local complications related to abnormal LN ^b	0
Disease-related mortality	0

Most small-size neck recurrences grow slowly over time



Long-Term Efficacy of Lymph Node Reoperation for Persistent Papillary Thyroid Cancer

Osama Al-Saif, William B. Farrar, Mark Bloomston, Kyle Porter, Matthew D. Ringel, and Richard T. Kloos

Conclusions: Surgical resection of persistent PTC in cervical lymph nodes achieves BCR, when most stringently defined, in 27% of patients, sometimes requiring several surgeries. No biochemical or clinical recurrences occurred during follow-up. In patients who do not achieve BCR, Tg levels were significantly reduced. The long-term durability and impact of this intervention will require further investigation. (*J Clin Endocrinol Metab* 95: 2187–2194, 2010)

Surgical resection of PTC persistence achieves biochemical cure in 27 - 50% of patients

Percutaneous Ultrasound-Guided Laser Ablation Is Effective for Treating Selected Nodal Metastases in Papillary Thyroid Cancer

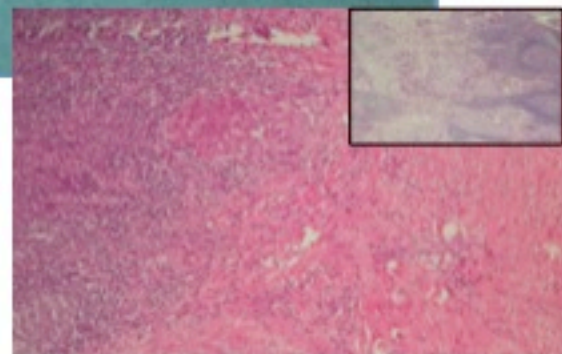
Enrico Papini, Giancarlo Bizzarri, Antonio Bianchini, Dario Valle, Irene Misischi, Rinaldo Guglielmi, Massimo Salvatori, Luigi Solbiati, Anna Crescenzi, Claudio Maurizio Pacella, and Hossein Gharib



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J Clin Endocrinol Metab, January 2013, 98(1):E92–E97

- 71-yr old woman with locally advanced PTC
- Total thyroidectomy and central and lateral neck dissection
- Radioiodine treatment
- Single nodal recurrence in the left laterocervical compartment
- US-guided laser treatment two weeks before surgical resection



Histologic examination: 7 x 6 mm zone of coagulative necrosis in the central part of the lymph node.



Repeat cervical recurrence of papillary thyroid cancer.

Laser Ablation Procedure



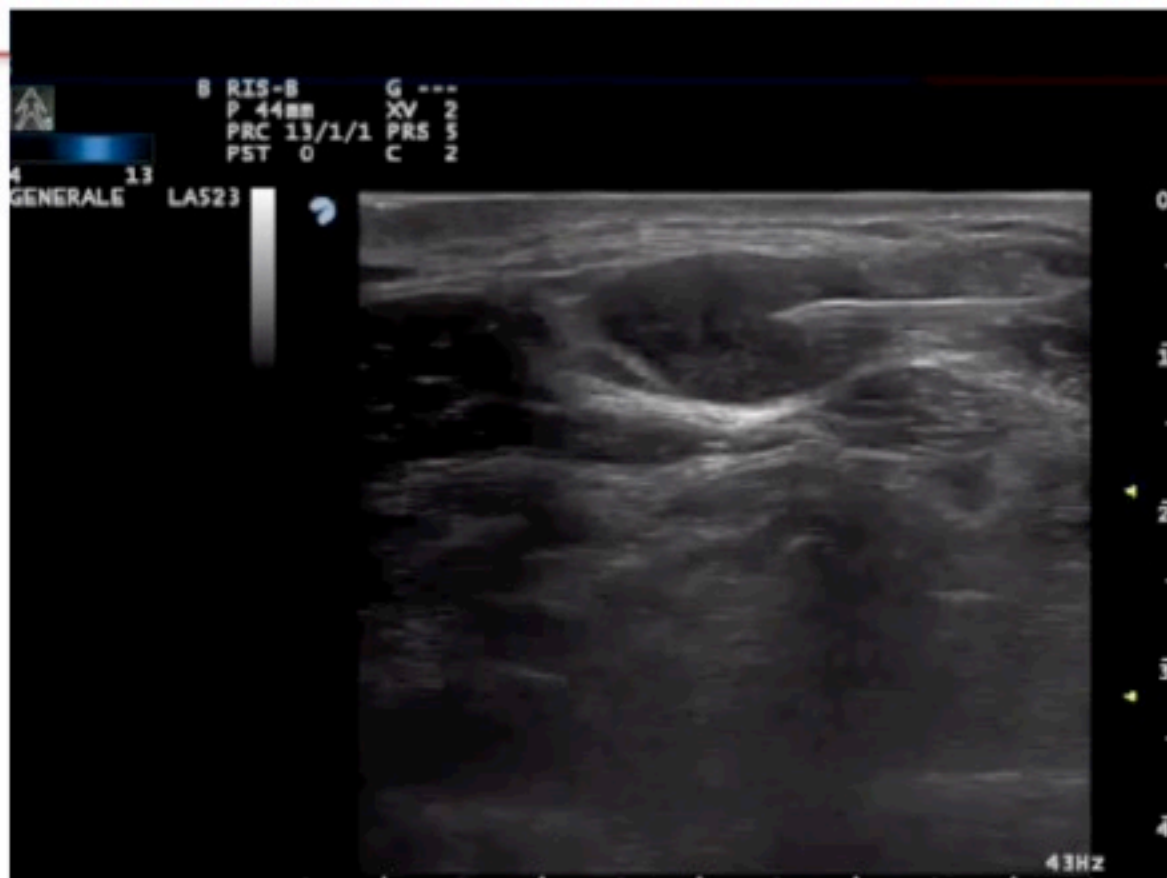


Metastatic lymph node ablation: Procedure



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Laser ablation. Cervical situation at the end of treatment



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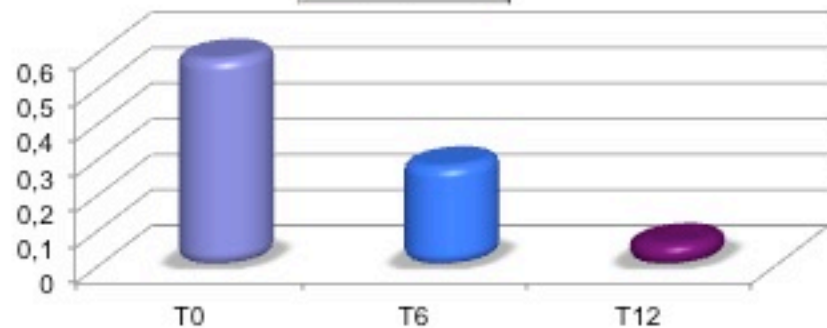


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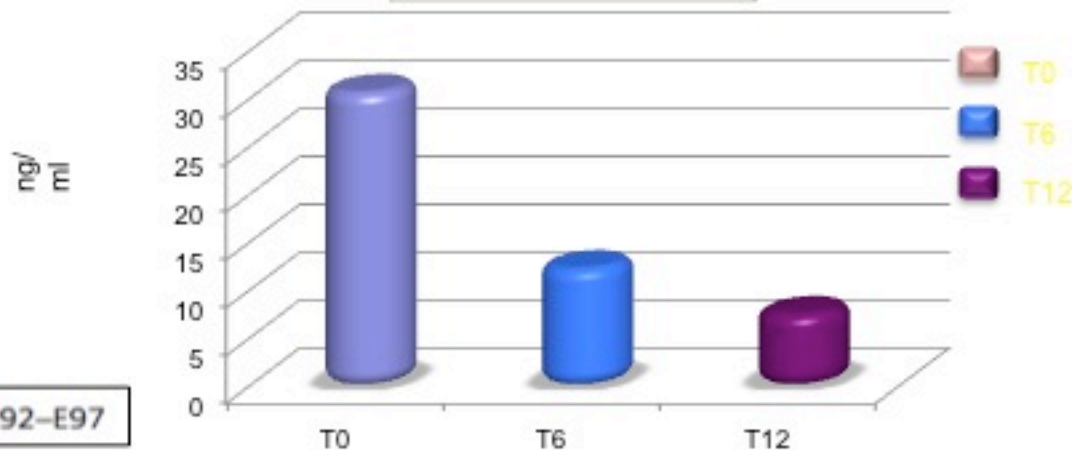
Laser Treatment of 5 patients with 8 cervical nodal metastasis of DTC: results at one year



Volume



Thyroglobulin





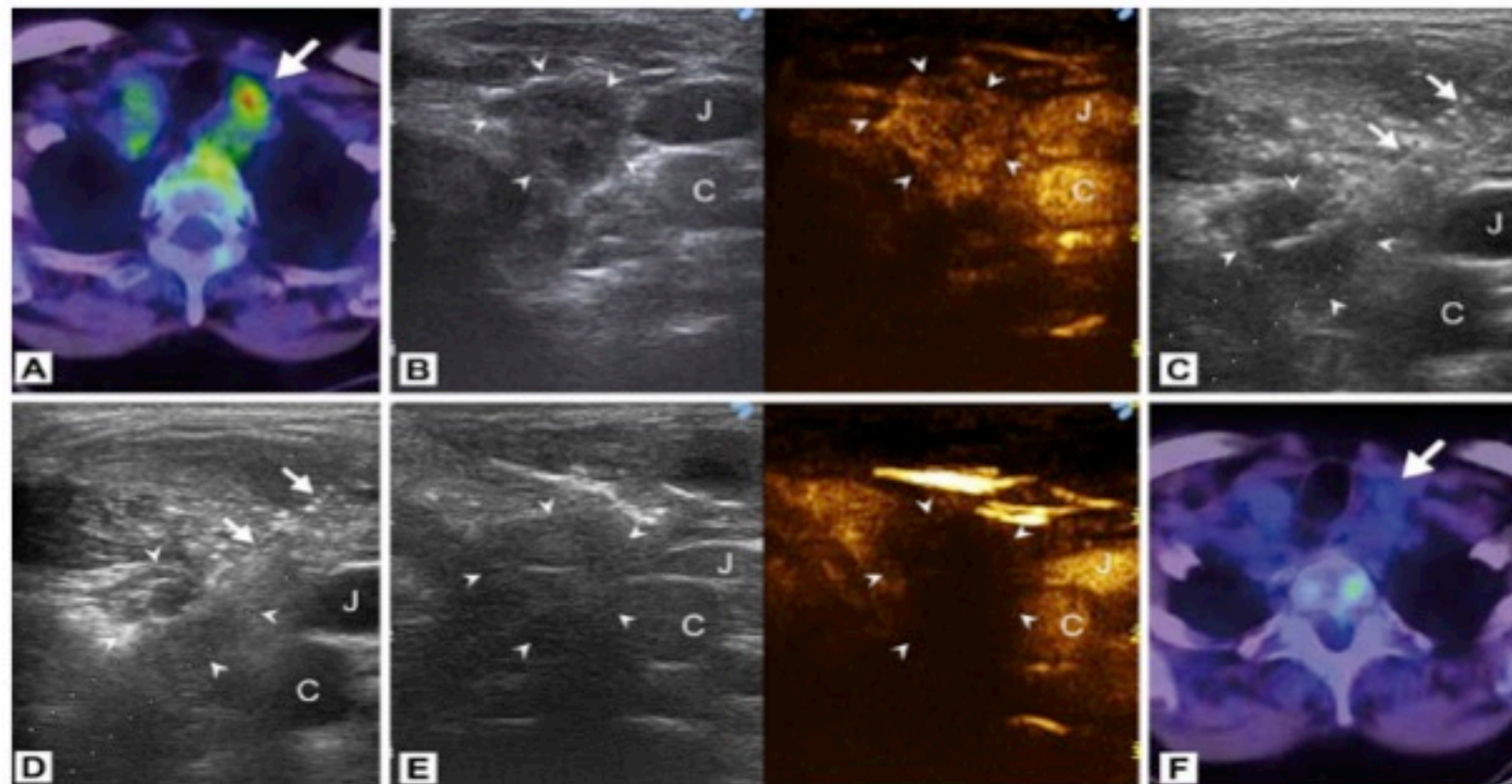
Percutaneous Laser Ablation of Metastatic Lymph Nodes in the Neck from Papillary thyroid carcinoma: preliminary results

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G. Mauri¹, L. Cova¹, T. Tondolo¹, T. Ierace¹, A. Baroli², E Di Mauro³, C.M. Pacella³, S.N. Goldberg⁴, L. Solbiati¹





National
Comprehensive
Cancer
Network®

NCCN Guidelines Version 2.2017 Thyroid Carcinoma – Medullary Carci

RECURRENT OR PERSISTENT DISEASE DISTANT METASTASES

Asymptomatic
disease



Observe
or
Consider resection (if possible), ablation (eg, RFA,
embolization, other regional therapy), or vandetanib^{o,p}
(category 1), or cabozantinib^o (category 1) if not
resectable and progressing by RECIST criteria^{q,r}



We may follow-up microPTCs without surgery.

Can we do something more than just a watchful-waiting?



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Laser Ablation for papillary thyroid microcarcinoma



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Conclusions

- Relapsing thyroid cysts should be managed with PEIT as first line treatment
- In solid nonfunctioning thyroid nodules, PLA and RFA achieve a > 50% volume decrease and local symptoms improvement
- Surgery remains the established approach for symptomatic, large size, nodular goiter
- In patients who are not good candidates for surgery MIT is a promising technique for local control of thyroid cancer recurrences and, possibly, papillary microcarcinomas.



Thank you for your attention

