



# Noduli tiroidei: le terapie mini-invasive



ITALIAN CHAPTER

Roma, 8-11 novembre 2018

## Le indicazioni al trattamento dei noduli benigni

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# Conflitti di interesse



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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 ho avuto rapporti diretti di finanziamento con i seguenti soggetti portatori di interessi commerciali in campo sanitario:

**NESSUNO**



# Noduli tiroidei



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- La prevalenza ecografica di noduli tiroidei è del 50-70% nella popolazione generale
- La malignità è presente nel 5-10% dei casi
- La maggior parte dei noduli benigni è asintomatica e cresce lentamente
- I noduli benigni asintomatici non necessitano di trattamento
- Noduli benigni asintomatici: follow-up clinico ed ecografico ogni 12-24 mesi



# Noduli tiroidei

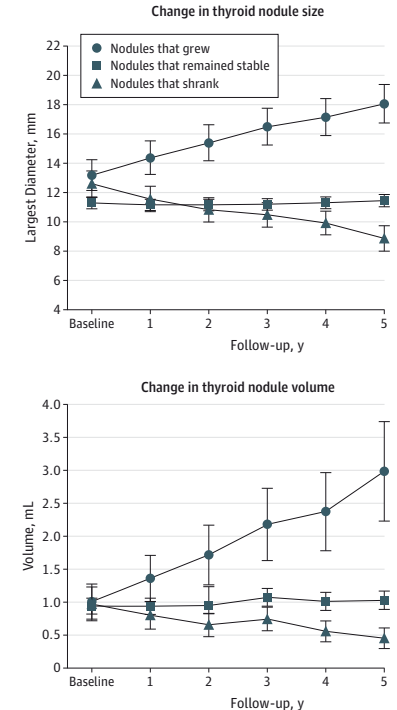


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- Circa il 10% dei noduli benigni è sintomatico
- Circa il 15% dei noduli benigni tende a crescere
- La FNAB conferma quasi sempre la natura benigna del nodulo in accrescimento

Figure 1. Changes in Thyroid Nodule Size and Volume During the First 5 Years of Follow-up



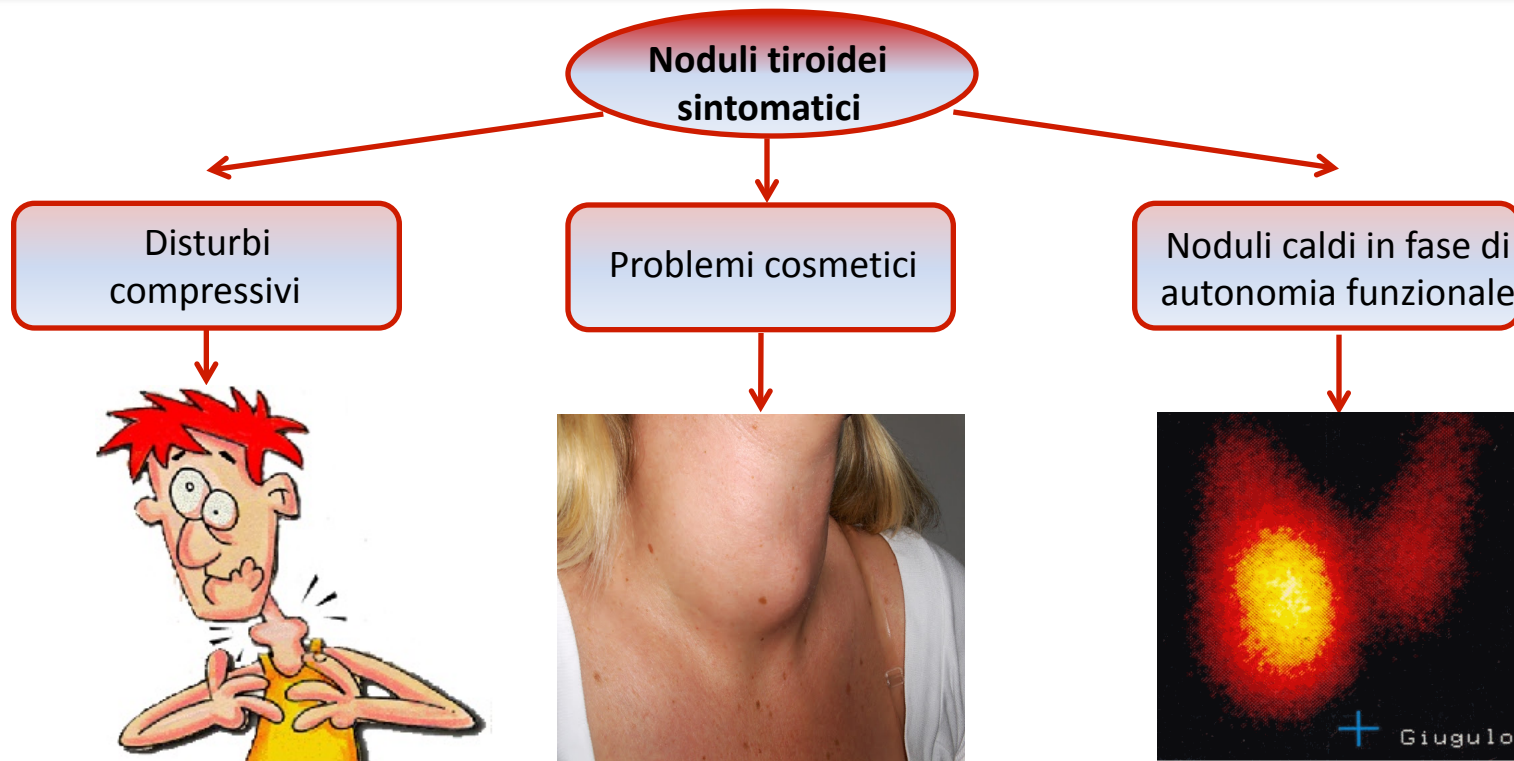


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# Noduli tiroidei benigni sintomatici



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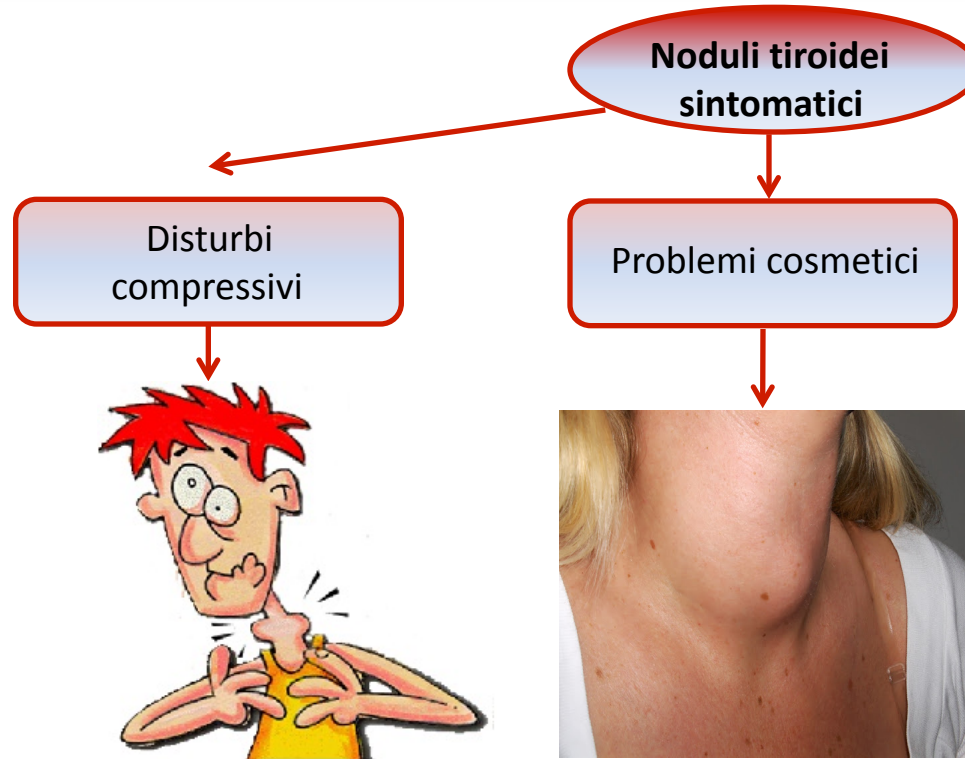


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# Noduli tiroidei benigni sintomatici



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# Noduli tiroidei benigni



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## Noduli tiroidei benigni, in accrescimento/sintomatici

- La terapia medica non è raccomandata
- La terapia chirurgica è sicuramente risolutiva



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# Chirurgia del nodulo tiroideo benigno



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## Vantaggi

- Rapida risoluzione dei sintomi
- Sicura in Centri ad “alto volume chirurgico”
- MA.....



## Svantaggi

- Elevati costi
- Rischio operatorio
- Possibile ipotiroidismo
- Complicanze post-chirurgiche permanenti, e comunque non sempre rare
- Danno estetico permanente
- Alcuni pazienti rifiutano la chirurgia





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# Noduli tiroidei benigni



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## Abbiamo alternative alla chirurgia?





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# Tecniche mini-invasive, ecoguidate, non chirurgiche



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- ✓ Percutaneous Ethanol Injection (PEI)
- ✓ Thermal ablation techniques
  - ✓ Radiofrequency ablation (RFA)
  - ✓ Laser ablation (LA)
  - ✓ Microwave ablation (MWA)
  - ✓ High-intensity Focused UltraSound (HIFU) ablation



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# Noduli benigni sintomatici



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- Noduli cistici o prevalentemente cistici
- Noduli solidi o prevalentemente solidi
- Noduli iperfunzionanti/autonomi



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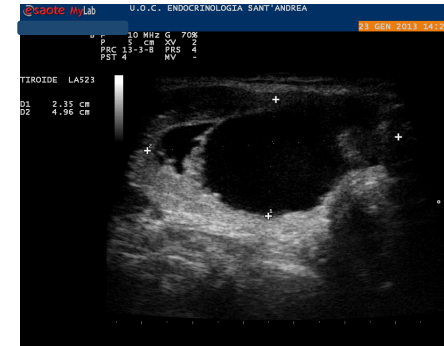
# Noduli benigni cistici



ITALIAN CHAPTER

## Simona, 32 anni

- Nodulo prevalentemente cistico del lobo destro
- Volume nodulare 34 ml (5.5 x 5 x 2.4 cm), in incremento
- Normale funzione tiroidea
- Calcitonina normale
- Disturbi compressivi
- Danno estetico
- Già data indicazione chirurgica





# Noduli cistici



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- Il 15-25% dei noduli tiroidei è cistico o prevalentemente cistico
- La percentuale di liquido è variabile, almeno 20% del volume
- Il 18-37% delle exeresi chirurgiche tiroidee è eseguito per noduli cistici

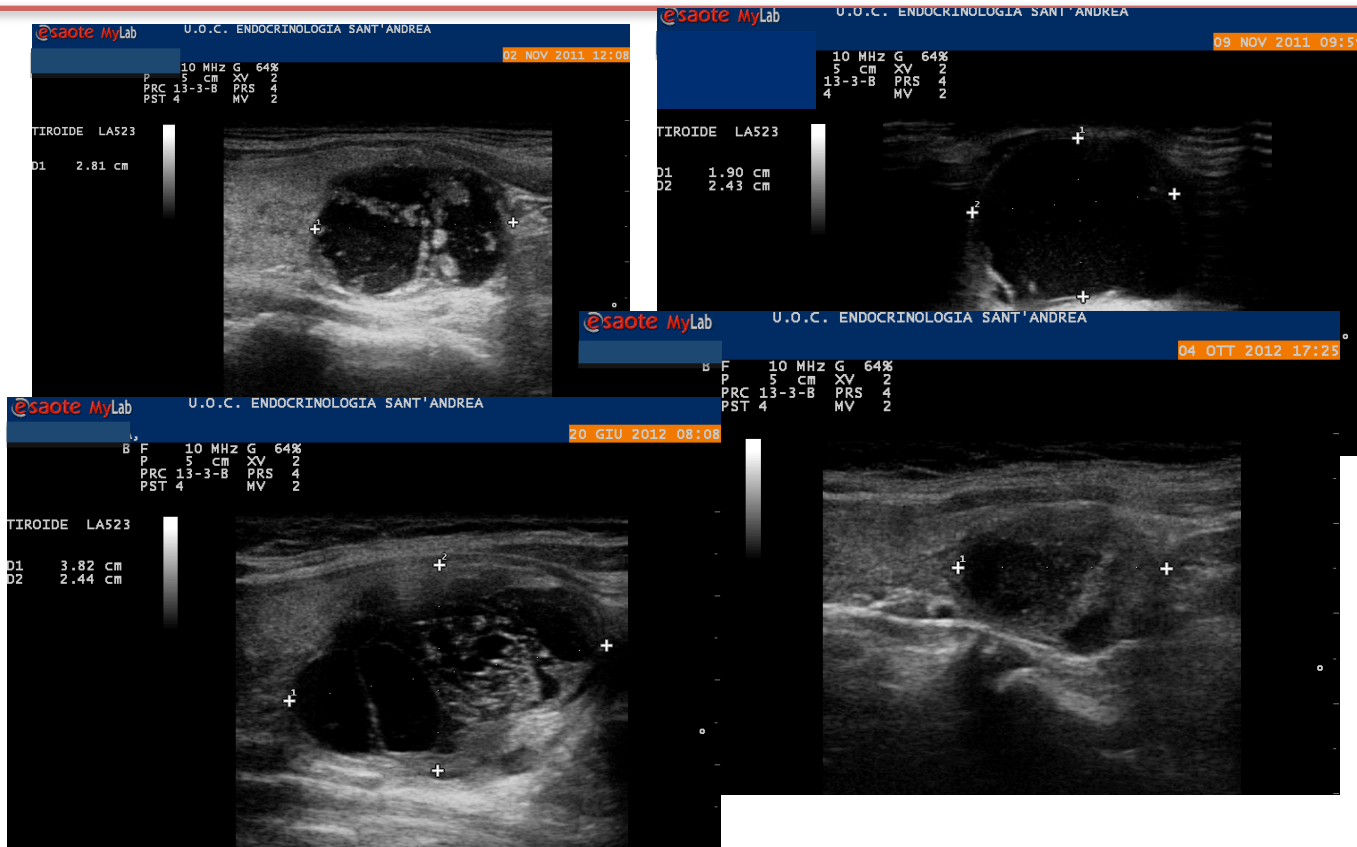


# Differente componente cistica



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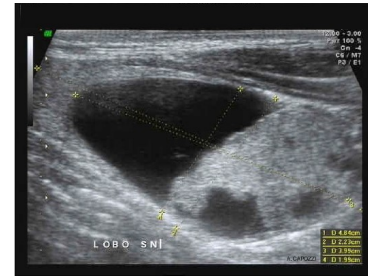
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# Gestione del nodulo cistico



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- Agoaspirato con aspirazione e svuotamento della cisti:  
procedura diagnostica (esame citologico)  
procedura terapeutica
- Agoaspirato anche su porzione solida del nodulo, se presente



**Rischio di malignità varia dal 2% al 18%**

Kim DW et al, AJNR 2010  
Nam-Goong IS et al, Clin Endocrinol 2004  
Bellantone R et al, Thyroid 2004  
McHenry Cret al, Surgery 1999



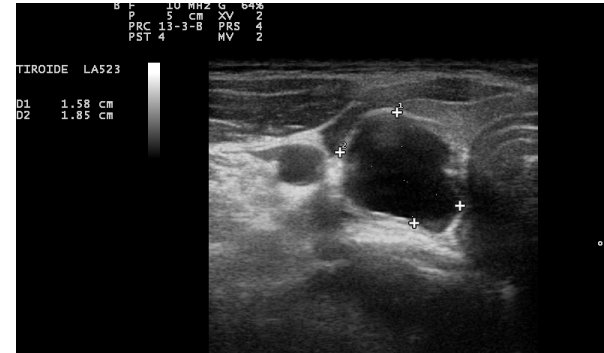
# Nodulo tiroideo cistico



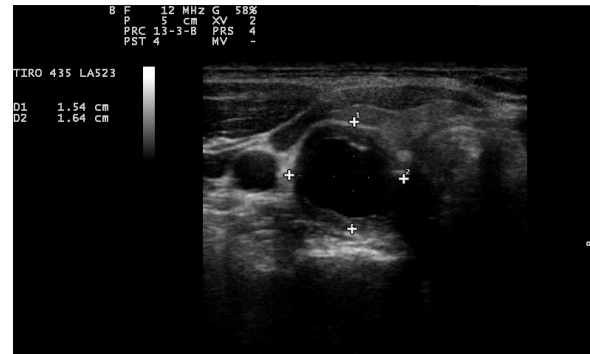
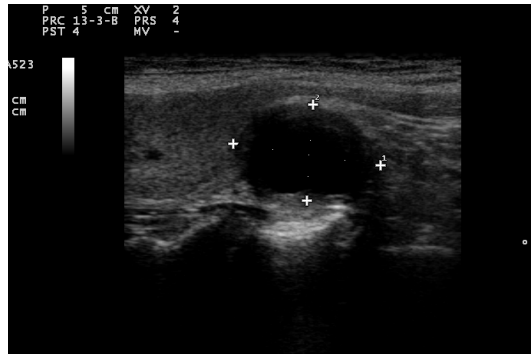
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## Svuotamento



Recidiva dopo la semplice aspirazione: 80-90% delle cisti





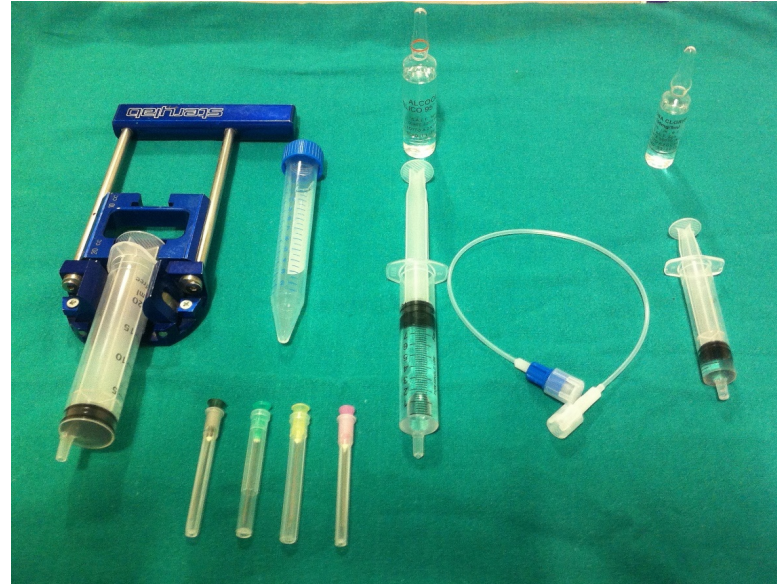


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# Alcolizzazione



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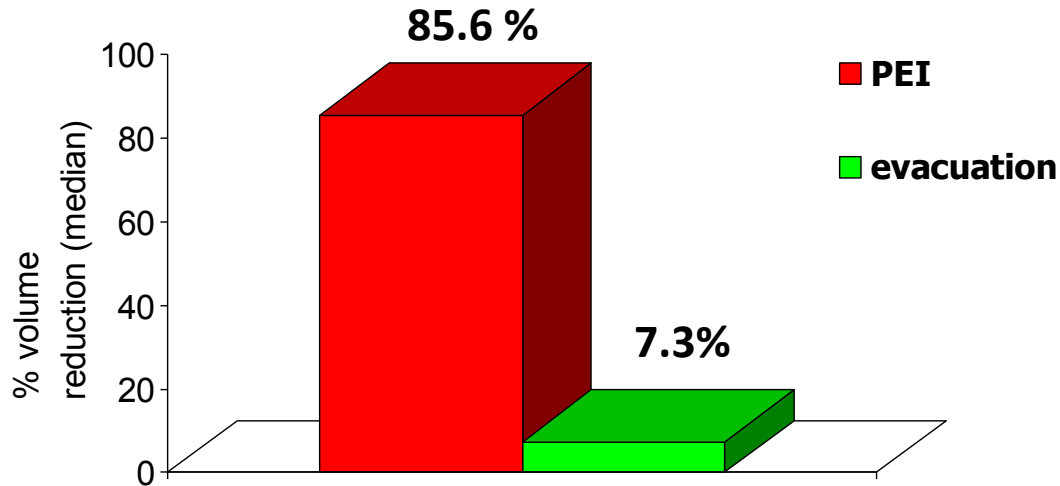




# Nodulo tiroideo cistico



## PEI of Cystic Thyroid Nodules % volume reduction after 1 yr





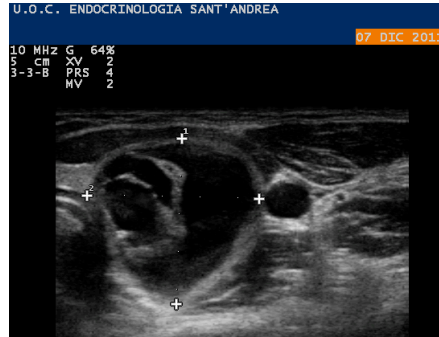
# Alcolizzazione (PEI): efficacia



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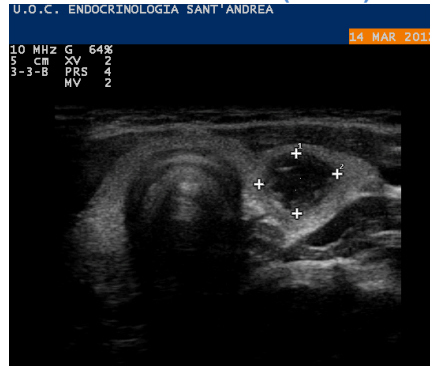
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Volume 8.2 ml



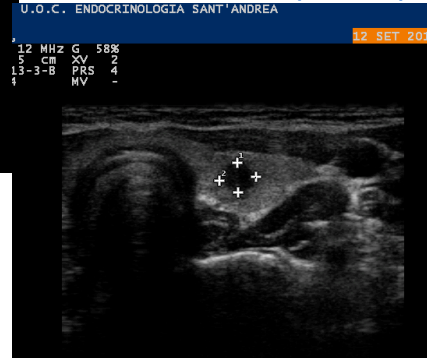
PEI

Volume 0.73 ml (- 89%)



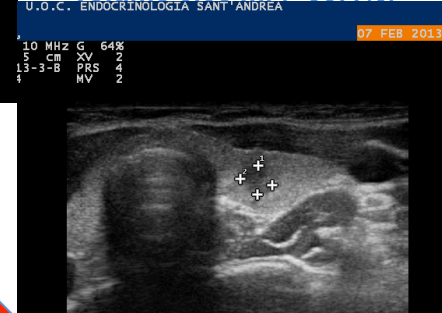
1 mese

Volume 0.07 ml (- 99.1%)



6 mesi

Volume 0.05 ml (- 99.4%)



12 mesi

12 mesi



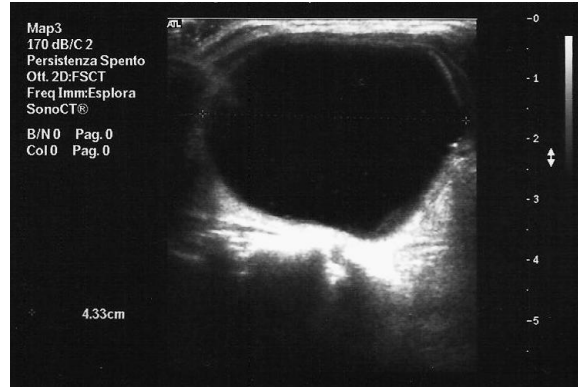


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# Alcolizzazione di cisti tiroidea



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**Pre-alcoolizzazione**

Volume: 31.2 ml



**Post-alcoolizzazione**

Volume: 0.01 ml

Riduzione del volume nodulare del 99.9%

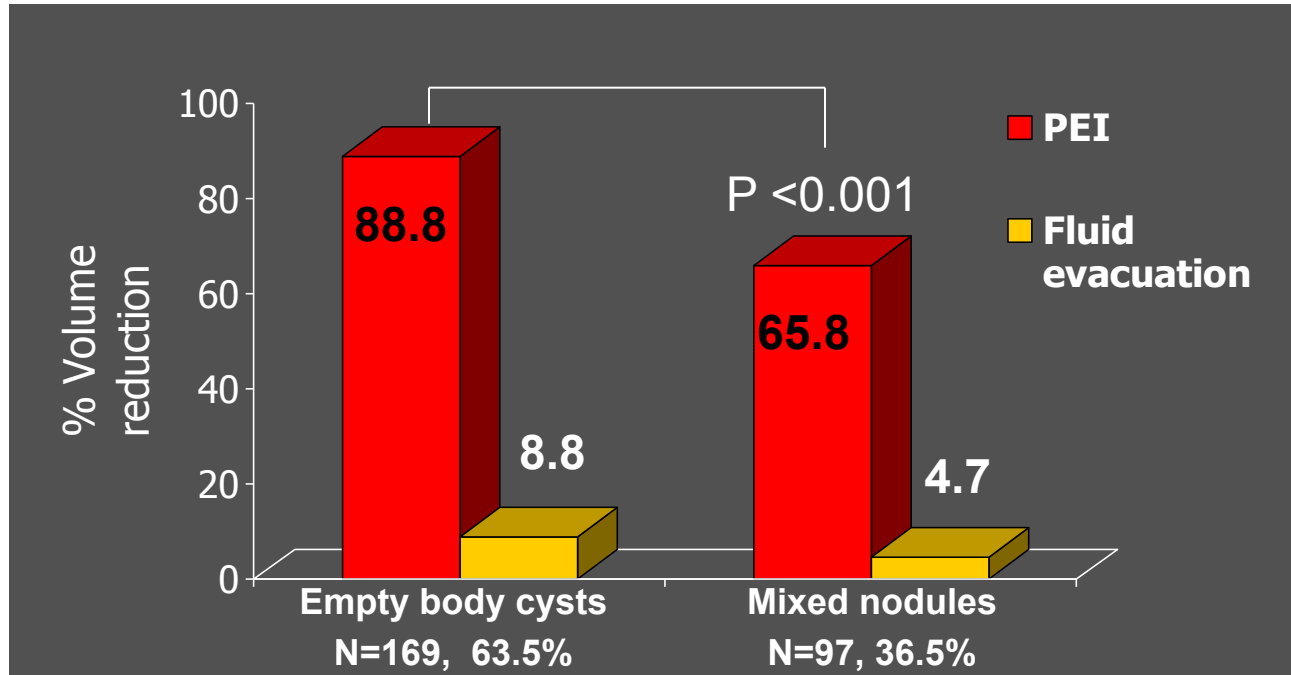


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# Percutaneous Ethanol Injection (PEI) in cystic thyroid nodules: empty body vs mixed cysts



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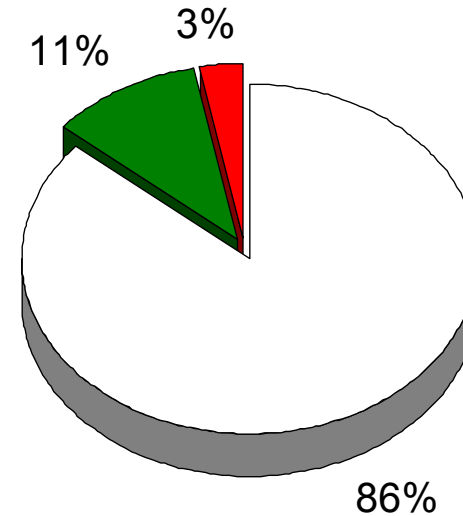
# PEI: long-term follow-up



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- 5-year follow-up after PEI (58 cases)
- Median treatments: 2
- **Effective**: decrease  $>75\%$  and improvement of local symptoms
- **Ineffective**: decrease  $<75\%$  or persistence of local symptoms



□ effective    ■ ineffective    ■ relapse



# PEI: long-term follow-up



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## A 7-year follow-up of patients with thyroid cysts and pseudocysts treated with percutaneous ethanol injection: volume change and cost analysis

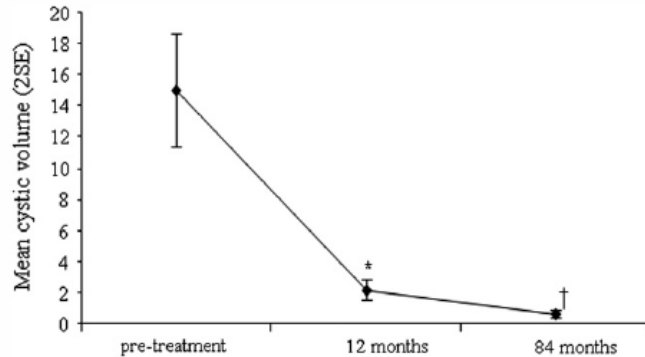


Fig. 4 Mean values  $\pm$  2SE of cystic volumes at the various follow-up. \*  $p < 0.001$ ; the student T-Test (two tailed); before treatment. †  $p < 0.001$ ; the student T-Test (two tailed); 12 months after treatment.

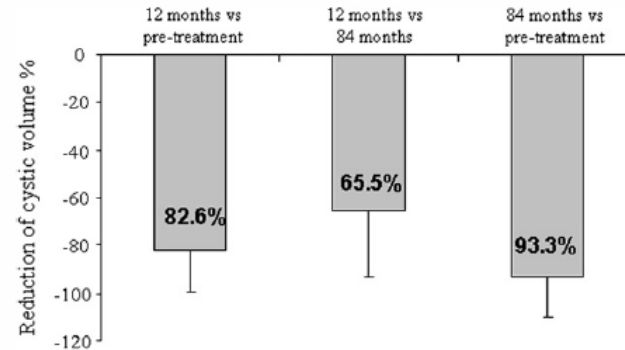


Fig. 5 Mean values  $\pm$  SD of cystic volume reduction expressed in percentages related to the 84-month follow-up and to the intermediate periods from pre-treatment to 12 months and from 12 months to 84 months.



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# Benign Cystic Thyroid Nodules: Ethanol versus Radiofrequency Ablation



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## Single-Session Treatment of Benign Cystic Thyroid Nodules with Ethanol versus Radiofrequency Ablation: A Prospective Randomized Study

- Results: the mean volume reduction was 96.9% in ethanol ablation (EA) and 93.3% in radiofrequency (RF) ablation
- Conclusion: EA may be the first-line treatment modality for cystic thyroid nodules, which has comparable therapeutic efficacy to, but is less expensive than, RF ablation





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# Costo materiali di consumo PEI



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Prodotto	Costo con IVA
Sodio cloruro 0.9 % 1fl da 10 ml	0.060
Alcool 95% 1 fl da 10 ml	2.948
Lidocaina cloridrato 1 fl da 5ml	0.197
Ago ipodermico	0.018
Tubicino prolunga	2.013
Provetta 15 ml tappo a vite	0.119
Siringa 20 ml	0.088
Siringa 10 ml	0.059
Siringa 5 ml	0.040
<b>TOTALE MATERIALE DI CONSUMO</b>	<b>5.500</b>

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# PEI cisti tiroidee



## Vantaggi

- Rapida riduzione del volume nodulare
- Nessun danno estetico permanente
- Lieve o assente dolore locale
- Non ipotiroidismo
- Costi esigui
- Non anestesia generale
- Non tecnologia avanzata
- Procedura ambulatoriale
- Pochi minuti (10-15)

## Svantaggi

- Persistenza del nodulo tiroideo
  - corretta valutazione citologica
  - necessità di follow-up
- Necessità di un operatore esperto
- Possibilità di ripetere la procedura



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# Alcolizzazione (PEI): possibili indicazioni



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- **Noduli tiroidei cistici**
- Noduli tiroidei solidi benigni “caldi” e “freddi”
- Paratiroidi
- Metastasi linfonodali di carcinoma papillare tiroideo



# AACE/ACE/AME Guidelines 2016



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## 7.2.4. Percutaneous ethanol injection for benign nodules

- Percutaneous ethanol injection (PEI) is a safe and effective outpatient therapy for thyroid cysts and complex nodules with a large fluid component [BEL 1, GRADE A]
- Sample carefully the solid component of complex lesions before doing PEI [BEL 3, GRADE B]
- **PEI is recommended as the first-line treatment for relapsing benign cystic lesions** [BEL 1, GRADE A]
- PEI is not recommended for solid nodules, whether hyperfunctioning or not, or for MNGs. This procedure may be considered for hot nodules having compressive symptoms only when other treatment modalities are not accessible [BEL 2, GRADE A]



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# Noduli benigni sintomatici



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- Noduli cistici o prevalentemente cistici
- Noduli solidi o prevalentemente solidi
- Noduli iperfunzionanti



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# Noduli solidi benigni



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## Francesco, 42 anni

- Nodulo tiroideo solido, lobo sinistro
- Volume nodulare 29 ml (4.5 x 2.9 x 4.3 cm)
- Lento e progressivo accrescimento negli ultimi 5 anni
- Due volte Tir 2
- Disturbi compressivi
- Normale funzione tiroidea
- Calcitonina normale
- Rifiuta la chirurgia





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# Noduli tiroidei solidi benigni



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## Abbiamo alternative alla chirurgia?





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# Nodulo tiroideo: Terapie Mininvasive (MIT)



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## Procedure Termo-Ablative nel nodulo tiroideo benigno

- **Laser**
- **Radiofrequenza**
- **Microwave**
- **High-intensity focused US (HIFU)**

### **Obiettivo**

- Ridurre il volume dei noduli e ridurre/eliminare i sintomi locali correlati
- Evitare la tiroidectomia e le complicanze chirurgiche
- Prevenire la progressiva crescita del nodulo





# LASER ABLATION (LA)



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Author	Pts/nodules no.	RCT	US pattern <sup>a</sup> Solid-cystic	Baseline (vol ml mean)	Nodule function hot/cold no.	Laser source	Energy load (J/ml mean)	Number of sessions (mean)	FU mo	Volume reduction (% mean)
Dossing <i>et al.</i> (2002) (81)	16		Solid	10.0	Cold	820 diode	761 (median)	1	6	46
Dossing <i>et al.</i> (2003) (84)	1		Solid	8.2	Hot	820 diode		1	9	40 (median)
Spiezia <i>et al.</i> (2003) (97)	12		Solid	3.2/11.1	7/5	Nd:YAG		1/2.2	12	74/61
Pacella <i>et al.</i> (2004) (82)	24		Solid	8.0/22.7	16/8	Nd:YAG	816/788	2.7/4.1	6	62/63
Papini <i>et al.</i> (2004) (98)	20		Solid	24.1	Cold	Nd:YAG	300	2.2	6	64
Dossing <i>et al.</i> (2005) (85)	15 vs 15	Yes	Solid	8.2	Cold	820 diode	224 (median)	1	6	44 (median)
Dossing <i>et al.</i> (2006) (87)	10		Cystic-solid	9.6	Cold	820 diode	254 (median)	1	12	57 (median)
Amabile <i>et al.</i> (2006) (83)	23		Solid	15.0	Cold	980 diode	33	1.2	3	36
Dossing <i>et al.</i> (2006) (86) <sup>b</sup>	15 vs 15	Yes	Solid	10.1/10.7	Cold	820 diode	262 vs 412	1	6	45 vs 58 (median)
Gambelunghe <i>et al.</i> (2006) (99)	15 vs 15	Yes	Solid	8.2	7/15 vs 6/5	Nd:YAG	1900 (median)	1	50 weeks	44
Cakir <i>et al.</i> (2006) (92)	12/15		Solid	11.9	Cold	810 diode	2726	1.5	12	82
Barbato <i>et al.</i> (2007) (100)	16		Solid	21.1	Hot	Nd:YAG		3	12	59
Dossing <i>et al.</i> (2007) (88) <sup>d</sup>	14 vs 15	Yes	Solid	10.6/11.2	Hot	820 diode	217	1	6	44 (median)
Papini <i>et al.</i> (2007) (101) <sup>e</sup>	21 vs 21 vs 20	Yes	Solid	11.7/13.6/12.1	Cold	Nd:YAG	1221	1	12	> 40
Valcavi <i>et al.</i> (2008) (102)	119		Solid	24.8	Cold	Nd:YAG		1	12	56
Valcavi <i>et al.</i> (2008) (102)	1		Solid	2.5	Hot	Nd:YAG		1		CR
Rotondi <i>et al.</i> (2009) (96)	1		Solid	55.0	Hot	980 diode		4	10	91
Valcavi <i>et al.</i> (2010) (103) <sup>f</sup>	122		Solid	23.1	Cold	Nd:YAG	484 (median per nodule)	1	36	48
Dossing <i>et al.</i> (2011) (89)	78	Yes	Solid	8.2	Cold	820 diode	242 (median)	1	67	51 (median)
Amabile <i>et al.</i> (2011) (91) <sup>g</sup>	78		Solid	55.3/55.3	51/26	980 diode	391/379	3.2 cycle	12	81.3/81.9
Gambelunghe <i>et al.</i> (2013) (80) <sup>h</sup>	20/20		Solid	15/14	Cold	Nd:YAG	71/579 (median)	1	36	+ 11/57
Gambelunghe <i>et al.</i> (2013) (104) <sup>i</sup>	50/50		Solid	21/21	Cold	Nd:YAG	502/499	1	6	55/56 (median)
Dossing <i>et al.</i> (2013) (90)	22 vs 22	Yes	Mixed	10.0/11.8	Cold	820 diode	83 (median)	1	6	26 vs 73 (median)



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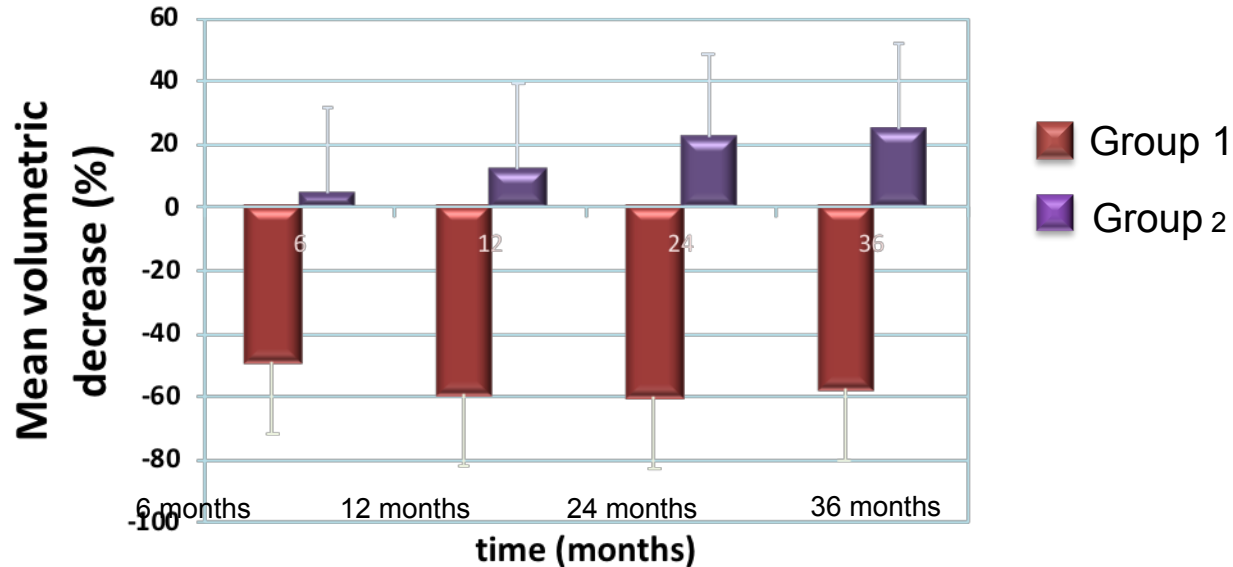
# Italian Multicenter Study on Laser Ablation of Cold Thyroid Nodules. Three-Year Results



ITALIAN CHAPTER



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)





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# LASER ABLATION (LA)



ITALIAN CHAPTER



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

**Results:** Total number of treatments was 1837; 1280 (83%) of nodules had a single LAT session. Mean nodule volume decreased from  $27 \pm 24$  mL at baseline to  $8 \pm 8$  mL 12 months after treatment ( $P < .001$ ). 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 ( $P < .001$ ) and evidence of cosmetic signs from 86% to 8% of cases ( $P < .001$ ). Seventeen complications (0.9%) were registered. Eight patients (0.5%) experienced transitory voice changes that completely resolved at the ear-nose-throat examination within 2–84 days. Nine minor complications (0.5%) were reported. No changes in thyroid function or autoimmunity were observed.



## Procedure Termo-Ablative nel nodulo tiroideo benigno

- Laser
- **Radiofrequenza**
- Microonde
- High-intensity focused US (HIFU)



# Radiofrequency ablation (RFA)



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## Noduli tiroidei benigni

**Table 1** Published data about RF treatment of benign thyroid nodules

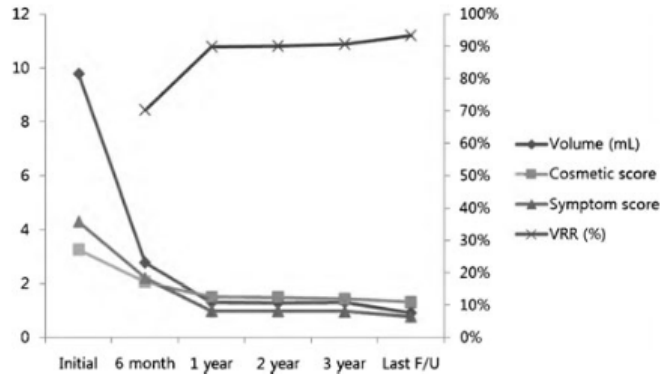
References	Journal	Treated nodules	Control group	US pattern (% of fluid component)	Scintiscan	Nodule volume at baseline (ml)	RF electrode type	RF session no.	Follow-up months	Volume reduction (%)
Kim [19]	<i>Thyroid</i>	35	No	Solid, mixed, cystic	Cold	6.3	17G c-e	1	6.4	73
Spiezia [22]	<i>J Am Geriatr Soc</i>	39	No			24	14G m-e	1-3	6	74
Jeong [20]	<i>Eur Radiol</i>	302	No	Solid, mixed, cystic		6.1	17G c-e	1-6	6	85
Baek [21]	<i>Thyroid</i>	1	No	Mixed	Hot	5.1	17G c-e		19	97
Deandrea [23]	<i>Ultrasound Med Biol</i>	33	No	Solid or mixed (<30 %)	23 Hot-10 cold	22.6-39.3	14G m-e	1	6	52-46
Spiezia [24]	<i>Thyroid</i>	94	No	Solid or mixed (<30 %)	28 Hot-66 cold	32.7-21.1	14G m-e	1-3	12	78
Spiezia [24]	<i>Thyroid</i>	Of whom 52	No	Solid or mixed (<30 %)			14G m-e	1-3	24	79
Baek [25]	<i>World J Surg</i>	9	No	Solid, mixed, cystic	Hot	15	17-18G c-e	1-4	6	71
Baek [26]	<i>Am J Roentgenol</i>	15	Follow-up	Solid or mixed	Cold	7.5	18G c-e	1	6	80
Lee [35]	<i>World J Surg</i>	27	No	Cystic or mixed (>50 %)		14	18G c-e	1-4	6	92 PEI + RF
Sung [33]	<i>Am J Roentgenol</i>	21	RF vs PEI	Cystic		10.2	17-18G c-e	1-3	6	92
Jang [36]	<i>Eur J Radiol</i>	20	No	Cystic or mixed (>50 %)		11.3	18G c-e	1-2	6	91 PEI + RF
Huh [27]	<i>Radiology</i>	15 vs 15	1 vs 2 RF sessions	Solid or mixed (<50 %)	Cold	13.3 vs 13.0	18G c-e	1 vs 2	6	70 vs 78 (ns)
Engel [28]	<i>J Clin Endocrinol Metab</i>	20	Follow-up	Solid or mixed (<30 %)	10 Hot-10 cold	13.3	14G	1	6	85
Lim [29]	<i>Eur Radiol</i>	126	No	Solid, mixed, cystic		9.8	17-18G c-e	1-7	49	93
Sung [34]	<i>Radiology</i>	25	RF vs PEI	Cystic		9.3	18G c-e	1	6	93
Turtulici [32]	<i>Ultrasound Med Biol</i>	45	No		Cold	13.5	18G c-e	1	6	72
Sung [37]	<i>Thyroid</i>	44	No	Solid or mixed (<90 %)	Hot	18.5	18G c-e	1-6	19.9	81
Cesareo [31]	<i>J Clin Endocrinol Metab</i>	42	Follow-up	Solid or mixed (<30 %)	Cold	24.5	17G c-e	1	6	68
Bernardi [30]	<i>Int J Endocrinol</i>	37	Surgery	Solid or mixed	12 Hot-25 cold	12.4	18G c-e	1-2	12	70

c-e Cooled electrode, m-e multitined electrode

Garberoglio et al 2015



## Radiofrequency ablation of benign non-functioning thyroid nodules: 4-year follow-up results for 111 patients



Variazioni  
del volume nodulare,  
dello score cosmetico,  
dello score dei sintomi  
e della percentuale di riduzione  
volumetrica rispetto al  
pretrattamento



# RFA vs volume



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	Baseline	1 Month	6 Months
Whole group (n = 42)			
TN volume	24.5 ± 19.6	17.5 ± 34.7 <sup>a</sup>	8.6 ± 9.5 <sup>a</sup>
TN volume variation, %		-49.7 ± 14.5	-68.6 ± 13.5
Small (n = 10)			
TN volume <b>&lt;12ml</b>	7.4 ± 2.7	3 ± 1.2 <sup>b</sup>	1.6 ± 1 <sup>b</sup>
TN volume variation, % <b>12-30ml</b>		-57.5 ± 8.6	-78.2 ± 10.7
Medium (n = 21)			
TN volume <b>&gt;30ml</b>	18.1 ± 4.4	9.3 ± 3 <sup>a</sup>	5.9 ± 2.5 <sup>a</sup>
TN volume variation, %		-47 ± 15	-67 ± 12.2
Large (n = 11)			
TN volume	52.3 ± 17.5	27.8 ± 13.7 <sup>c</sup>	20.1 ± 12.1 <sup>b</sup>
TN volume variation, %		-47.7 ± 16.3	-62.8 ± 14.8

Values are reported as mean ± SD. Differences in mean volumes are considered between value at 1 month and 6 month vs baseline.



# Radiofrequency Ablation

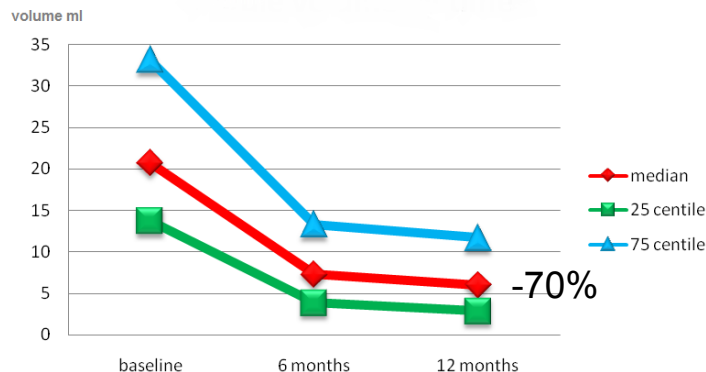


ITALIAN CHAPTER

Roma, 8-11 novembre 2018

## Radiofrequency Ablation for Benign Thyroid Nodules according to different US features: An Italian Multicentre Prospective Study

Visual scale	Compressive score (n of patients)	
	before	12 months
0	66	248
1	2	18
2	16	46
3	41	9
4	34	9
5	57	7
6	41	0
7	34	0
8	36	0
9	9	0
10	2	0
<b>MEDIAN</b>	<b>6.2</b>	<b>0.61</b>



Clinical evaluation	Cosmetic score (n of patients)	
	before	12 months
1	1	147
2	83	158
3	115	30
4	138	2
<b>MEDIAN</b>	<b>3.15</b>	<b>1.66</b>





# RF: An Italian Multicentre Prospective Study



ITALIAN CHAPTER

Roma, 8-11 novembre 2018

	Delivered energy (Joule/vol)	Volume before (median)	Volume 6 months (median)	Volume 12 months (median)	p
<b>Whole group (337 nodules)</b>	2180 J/ml	20,7ml	7,3ml (-63.5%)	6ml (-70%)	<0.001
<b>Volume &lt;15 ml (103 nodules)</b>	2940 J/ml	11,2ml	3,2ml	2,5ml (-76.7%)**	** <0.001
<b>Volume 15-30 ml (129 nodules)</b>	2200 J/ml	20,7ml	7,5ml	6,5ml (-67.3%)	
<b>Volume &gt;30 ml (105 nodules)</b>	1200 J/ml	41ml	16,6ml	15ml (-66.7%)	
<b>US pattern</b>	E1	21ml	7,5ml	6,6ml (-69%)	
	E2	19,9ml	6,2ml	4,9ml (-76%)**	**0.01
	E3	22,1ml	8ml	6,9ml (-68%)	
<b>Vascularity pattern</b>	V1	21,9ml	7,9ml	7,2ml (-68,8%)	
	V2	18,9ml	6,2ml	5,5ml (-71%)**	**<0.03
	V3	20,1ml	8,7ml	6,5ml (-67,9%)	
<b>Macrocalcifications</b>	M1	23ml	8,5ml	6,5ml (-71,5%)	**NS
	M2	20ml	6,9ml	6ml (-70%)	
	M3	24,8ml	9,5ml	8,2ml (-69,8%)	



# RF: An Italian Multicentre Prospective Study



ITALIAN CHAPTER

Roma, 8-11 novembre 2018

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<b>Volume &gt;30 ml (105 nodules)</b>	1200 J/ml	41ml	16,6ml	15ml (-66.7%)	
<b>US pattern</b>	E1 (Mixed)	21ml	7,5ml	6,6ml (-69%)	
	E2 (Spongiform)	19,9ml	6,2ml	4,9ml (-76%)**	**0.01
	E3 (Solid)	22,1ml	8ml	6,9ml (-68%)	
<b>Vascularity pattern</b>	V1	21,9ml	7,9ml	7,2ml (-68,8%)	
	V2	18,9ml	6,2ml	5,5ml (-71%)**	**<0.03
	V3	20,1ml	8,7ml	6,5ml (-67,9%)	
<b>Macrocalcifications</b>	M1	23ml	8,5ml	6,5ml (-71,5%)	**NS
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# RF: An Italian Multicentre Prospective Study



Roma, 8-11 novembre 2018

ITALIAN CHAPTER

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	E2 (Spongiform)	19,9ml	6,2ml	4,9ml (-76%)**	**0.01
	E3 (Solid)	22,1ml	8ml	6,9ml (-68%)	
<b>Vascularity pattern</b>	V1 Intense perinodular	21,9ml	7,9ml	7,2ml (-68,8%)	
	V2 Intra and perinodular	18,9ml	6,2ml	5,5ml (-71%)**	**<0.03
	V3 Weak perinodular	20,1ml	8,7ml	6,5ml (-67,9%)	
<b>Macrocalcifications</b>	M1	23ml	8,5ml	6,5ml (-71,5%)	**NS
	M2	20ml	6,9ml	6ml (-70%)	
	M3	24,8ml	9,5ml	8,2ml (-69,8%)	



Roma, 8-11 novembre 2018

# Noduli solidi benigni



ITALIAN CHAPTER



## Francesco, 52 anni

- Nodulo tiroideo solido, lobo destro
- Volume nodulare 29 ml (4.5 x 2.9 x 4.3 cm)
- Lento e progressivo accrescimento negli ultimi 5 anni
- Due volte Tir 2
- Disturbi compressivi
- Normale funzione tiroidea
- Calcitonina normale
- Rifiuta la chirurgia



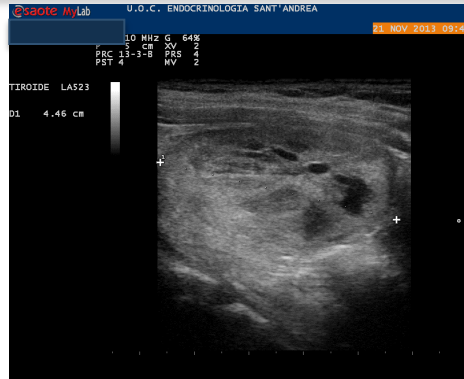


# Francesco, 52-year old: Radiofrequency ablation



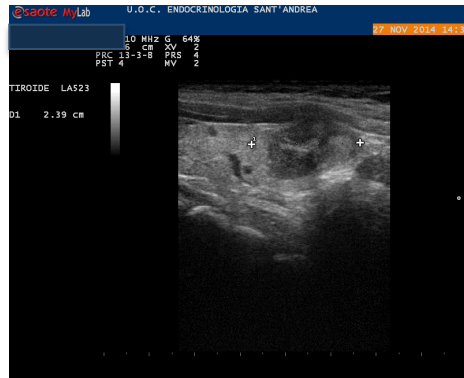
ITALIAN CHAPTER

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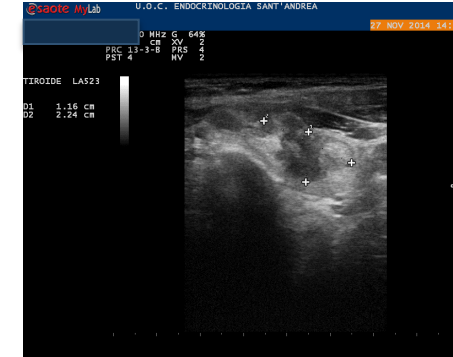


Volume 29 ml  
Local symptoms

RF



Volume 3 ml  
(-88.7%)  
No local symptoms





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# Terapie Mini-invasive CHI TRATTARE



ITALIAN CHAPTER



## QUANDO TRATTARE UN NODULO SOLIDO O PREVALENTEMENTE SOLIDO?

- Noduli tiroidei benigni: almeno due differenti agoaspirati (prelievi multipli)
- Noduli sintomatici, con disturbi compressivi: sensazione di corpo estraneo, tosse, senso di soffocamento/pressione, dolore al collo, dispnea, disfagia, disfonia
- Danno cosmetico
- Noduli tiroidei in progressivo accrescimento
- Pazienti con rischio operatorio o che rifiutano l'intervento



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# AACE/ACE/AME Guidelines 2016



ITALIAN CHAPTER



## 7.2.5. Image-guided Thermal Ablation for benign nodules

- Consider laser or radiofrequency ablation for the treatment of solid or complex thyroid nodules that progressively enlarge or are symptomatic or cause cosmetic concern [BEL 2, GRADE C]
- Repeat FNA for cytologic confirmation before thermal ablation treatment [BEL 3, GRADE B]



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# Noduli benigni sintomatici



ITALIAN CHAPTER



- Noduli cistici o prevalentemente cistici
- Noduli solidi o prevalentemente solidi
- Noduli iperfunzionanti/autonomi



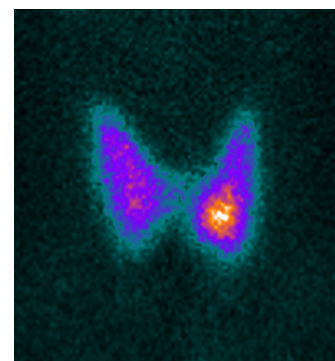
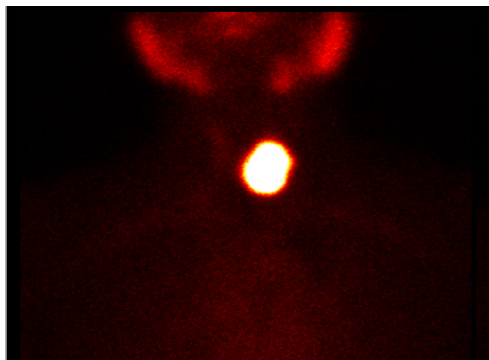
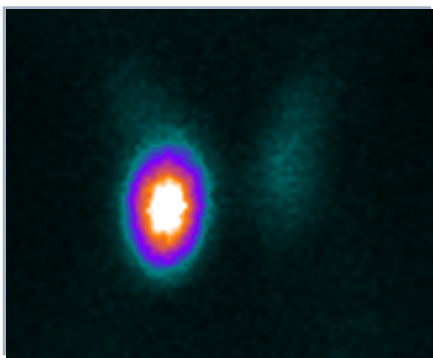


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# Noduli iperfunzionanti



ITALIAN CHAPTER





# AACE/ACE/AME Guidelines 2016



ITALIAN CHAPTER

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## 7.2.6. Radioiodine Therapy for Benign Nodular Goiter

- Consider **radioiodine therapy** for hyperfunctioning and/or symptomatic goiter, especially for patients with previous thyroid surgery or at surgical risk and in those who decline surgery [BEL 2, GRADE A].
- Perform FNA before radioiodine therapy on coexistent cold nodules, per the recommendations gives for nontoxic MNG [BEL 3, GRADE B].



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# Noduli tiroidei autonomi



ITALIAN CHAPTER



- RFA e LA riducono il volume dei noduli iperfunzionanti
- In circa il 40-90% vi è una risoluzione dell'ipertiroidismo
- I risultati migliori si ottengono nei noduli di minor volume (< 10/13 ml)
- Nei noduli più voluminosi, il pre-trattamento del nodulo con RFA/LA rende più efficace la terapia con radio-iodio (terapia di combinazione)

Dossing H et al, 2007  
Chianelli M et al, 2014  
Bernardi S et al, 2017  
Cesareo R et al, 2018  
Gambelunghe G et al, 2018



# Noduli tiroidei autonomi



ITALIAN CHAPTER

Roma, 8-11 novembre 2018

**Table 1.** Hormonal, Clinical, and Sonographic Changes in Group A (LAT+131I) at Baseline, at 1 Month (1 Month After LAT), 2 Months (2 Months After LAT and 1 Month After 131I) at 12 and 24 Months (12 Months After LAT and 11 Months After 131I) and in Group B (131I) at Baseline and 1, 2, 12, and 24 Months After 131I

Months Group	0		1		2		12		24	
	A	B	A	B	A	B	A	B	A	B
Treatment	No	No	LAT	131I	LAT + 131I	131I	LAT + 131I	131I	LAT + 131I	131I
SYS	2.7 ± 1.3	2.8 ± 1.3	2.1 ± 1.0	2.7 ± 1.4	1.7 ± 0.8 <sup>a</sup>	2.4 ± 1.2	1.2 ± 0.4	1.4 ± 0.6	1.1 ± 0.4	1.3 ± 0.5
Volume, mL (US)	27.7 ± 17.0	29.4 ± 10.6	23.5 ± 14.9	27.5 ± 10.5	20.6 ± 13.5	25.3 ± 9.8	10.1 ± 9.3	15.4 ± 5.3	9.6 ± 8.9 <sup>a</sup>	15.3 ± 5.1
Volume reduction, %			16.6 ± 6.2 <sup>b</sup>	7.5 ± 3.6	27.8 ± 9.1 <sup>b</sup>	15.0 ± 3.7	67.8 ± 13.2 <sup>b</sup>	46.9 ± 5.3	71.3 ± 13.4 <sup>b</sup>	47.4 ± 5.5
Free T <sub>3</sub> , pg/mL	4.06 ± 0.66	4.12 ± 0.78	3.73 ± 0.72	4.01 ± 0.56	3.17 ± 1.18	3.52 ± 0.83	3.13 ± 0.45	3.29 ± 0.78	3.38 ± 0.80	3.31 ± 0.72
Free T <sub>4</sub> , pg/mL	14.78 ± 4.64	15.02 ± 5.01	13.36 ± 3.99	13.96 ± 4.67	12.6 ± 5.12	13.43 ± 4.63	12.54 ± 5.43	12.37 ± 6.02	12.19 ± 4.84	12.38 ± 6.23
TSH, mIU/mL	0.04 ± 0.04	0.06 ± 0.06	0.66 ± 0.70	0.33 ± 0.21	0.87 ± 0.61 <sup>a</sup>	0.40 ± 0.28	1.66 ± 1.02	1.48 ± 1.02	1.71 ± 1.12	1.57 ± 1.07

Normal range, TSH, 0.2–4.0 mIU/mL; free T<sub>3</sub>, 2.2–5.0 pg/mL; free T<sub>4</sub>, 8.0–18.5 pg/mL.

<sup>a</sup>  $P < .05$ ; <sup>b</sup>  $P < .01$ , group A vs group B.



# Trattamento combinato RFA + I<sup>131</sup>

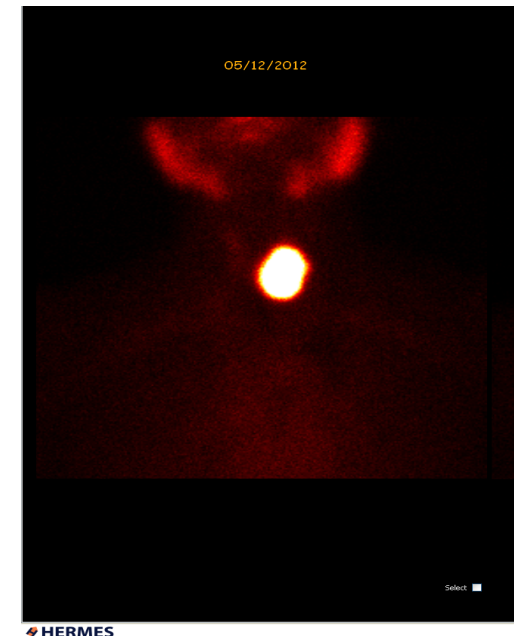


ITALIAN CHAPTER

Roma, 8-11 novembre 2018

**Carla, 49 anni**, affetta da:

- Tireopatia uninodulare
- **Iperitiroidismo** in trattamento con metimazolo (2 cp/die)
- **Sintomi compressivi**: intensità 9/10
- **Segni compressivi**: deviazione tracheale
- **Danno estetico**: nodulo visibile all'ispezione del collo (score 4)
- Visto il volume del nodulo (18.12 ml - D massimo 4.1 cm) non vi era indicazione a I<sup>131</sup>
- Veniva posta indicazione chirurgica che la paziente **rifiutava**





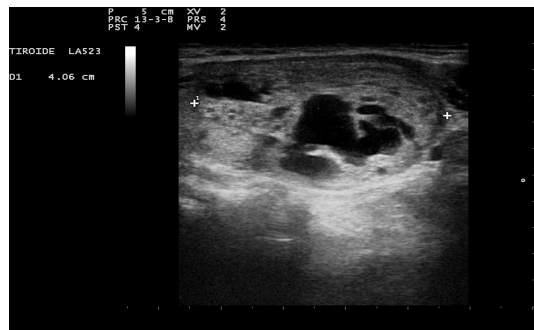
# Trattamento combinato RFA + I<sup>131</sup>



ITALIAN CHAPTER

Roma, 8-11 novembre 2018

Volume iniziale 18.12 ml (DL 4.1 cm)



12 mesi dopo RFA (- 72.8%)

Volume 4.9 ml (DL 3 cm)

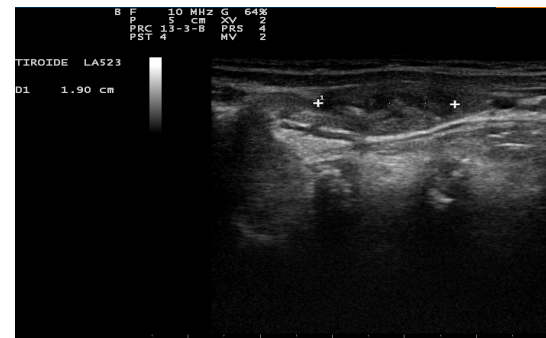


A 1 anno dal trattamento termoablattivo con radiofrequenze è stata trattata con 10 mCi di I<sup>131</sup>

21 mesi dopo RFA + I<sup>131</sup>

Volume finale 1 ml  
(DL 1.9 cm)

**Riduzione volumetrica totale ≈ 94%**



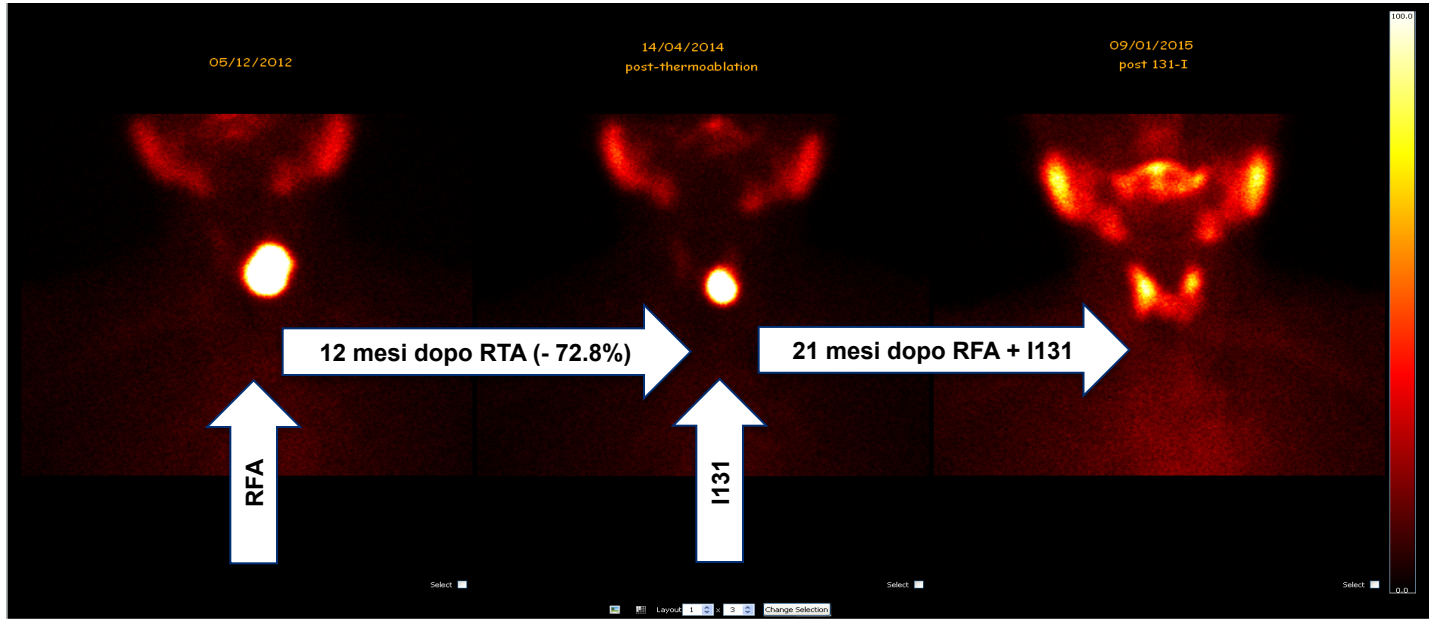


# Trattamento combinato RFA + I<sup>131</sup>



ITALIAN CHAPTER

Roma, 8-11 novembre 2018



**Eutiroidismo**  
**Scomparsa dei sintomi e del danno estetico**



# Terapie termo-ablative



Roma, 8-11 novembre 2018

ITALIAN CHAPTER

## Vantaggi

- ❖ Efficace riduzione del volume nodulare
- ❖ Diminuzione/risoluzione dei sintomi locali
- ❖ Nessun danno estetico
- ❖ Lieve o assente dolore locale
- ❖ Complicanze rare e transitorie
- ❖ Non ipotiroidismo
- ❖ Costi non eccessivi, minori della chirurgia
- ❖ Non anestesia generale
- ❖ Non tecnologia avanzata
- ❖ Procedura ambulatoriale
- ❖ Pochi minuti (30-60)

## Svantaggi

- ❖ Persistenza del nodulo tiroideo
  - corretta valutazione citologica
  - necessità di follow-up
- ❖ Necessità di un operatore esperto
- ❖ Complicanze potenzialmente severe nel periodo di apprendimento
- ❖ Assenza di un lungo follow-up
- ❖ Possibilità di ripetere la procedura





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# High-intensity focused ultrasound (HIFU)

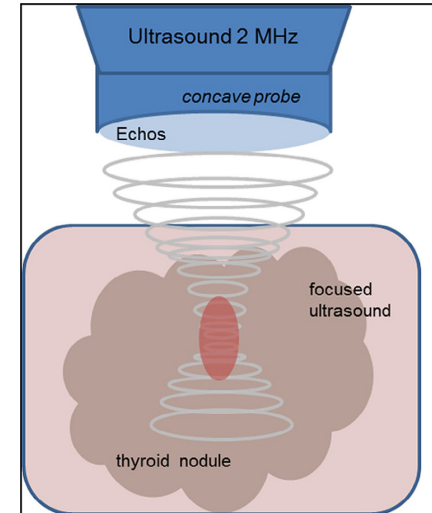


ITALIAN CHAPTER



HIFU is based on extracorporeal generation of ultrasound waves focused on an internal target. Energy propagates without damage through the skin to the inner focal point where the temperature has a sharp increase.

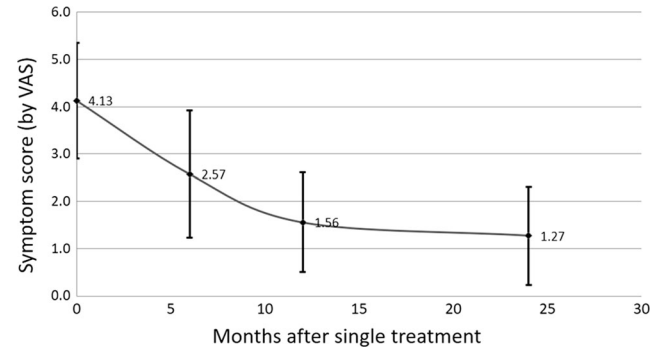
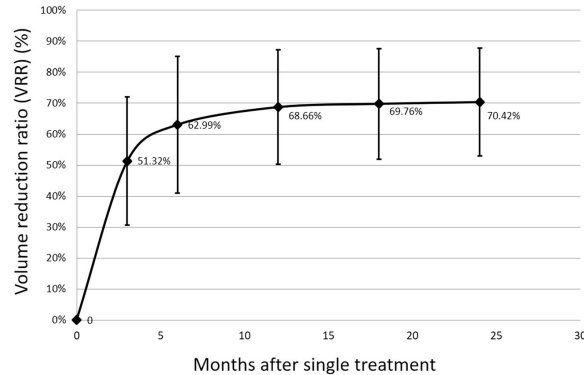
HIFU of benign thyroid nodules is a non-invasive thermal ablation technique





## Two-year efficacy of single-session high-intensity focused ultrasound (HIFU) ablation of benign thyroid nodules

108 nodules, volume  $13.09 \pm 10.54$  ml, maximum diameter  $3.52 \pm 1.11$  cm





## STATEMENT AND RECOMMENDATIONS ON INTERVENTIONAL ULTRASOUND AS A THYROID DIAGNOSTIC AND TREATMENT PROCEDURE

***Recommendation 15.*** HIFU of benign thyroid nodules is a non-invasive thermal ablation technique that should be carried out as an alternative therapy for **nodules  $\leq 10$  mL**, if the nodules are in a sufficient distance from the trachea, carotid artery and skin, in patients who **refuse surgery, radioiodine therapy and other more established minimally invasive local ablative treatment options** (RFA, MWA, LA)



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# Microwave Ablation



ITALIAN CHAPTER



## Ultrasound guided percutaneous **microwave ablation** of benign thyroid nodules: Safety and imaging follow-up in 222 patients

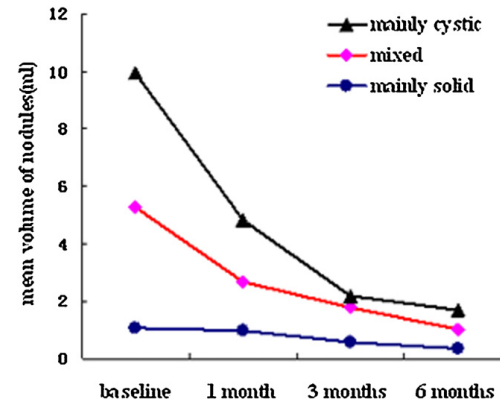
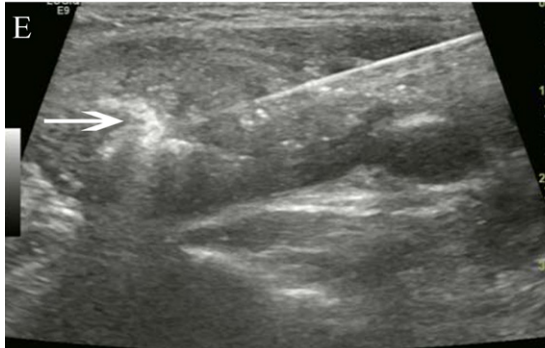


Fig. 3. Mean volume of mainly solid, mixed and mainly cystic nodules at baseline (time of microwave ablation) and at follow-up after treatment.

There was a volume reduction of 80% for cystic nodules, 72% for echo-complex nodules and 27% for solid nodules



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# Microwave Ablation

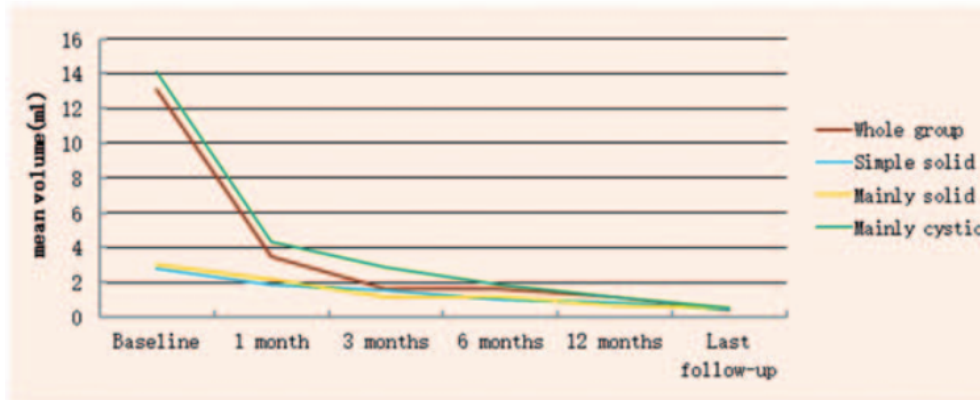


ITALIAN CHAPTER



## Ultrasound-guided microwave ablation in the treatment of benign thyroid nodules in 435 patients

Yu-Jiang Liu, Lin-Xue Qian, Dong Liu and Jun-Feng Zhao



474 noduli benigni in 435 pazienti: riduzione del volume medio a 1 anno 90%.

La riduzione volumetrica dei noduli prevalentemente cistici era maggiore rispetto ai noduli solidi o prevalentemente solidi. Non complicanze maggiori



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# Terapie Mini-invasive



ITALIAN CHAPTER



## Noduli tiroidei benigni

		PEI	LA	RFA	MVA	HIFU
Indicazioni	Noduli cistici o prevalent cistici	++++	++	++	++	+?
	Noduli solidi o prevalent solidi	+	++++	++++	-	++ piccoli
	<b>Noduli autonomi</b>	<b>+</b>	<b>+++</b>	<b>+++</b>	<b>-</b>	<b>?</b>
Efficacia		++++	++++	++++	++?	++?
Sicurezza		++++	+++	+++	-?	+++?
Formazione		+	+++	++++	++++?	++



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# Terapie mini-invasive



ITALIAN CHAPTER



- Le terapie mini-invasive sono indicate nei noduli tiroidei benigni sintomatici ed in accrescimento
- PEI è il trattamento di scelta per le cisti tiroidee benigne recidivanti
- Nei noduli solidi, non-funzionanti e autonomi, Laser (LA) e Radiofrequenza (RFA) sono entrambi efficaci (riduzione volumetrica  $> 50\%$  e miglioramento sintomi locali), con risultati sovrapponibili
- LA e RFA non sono metodiche competitive
- La scelta di una tecnica dipende dall'esperienza/disponibilità personale/locale



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# Terapie mini-invasive



ITALIAN CHAPTER



- Discutere sempre con il paziente tutte le opzioni, vantaggi, svantaggi e i limiti dei trattamenti
- LA e RFA sono metodiche alternative alla chirurgia, che rimane il trattamento di riferimento, soprattutto per voluminosi noduli
- Le terapie mini-invasive sono in grado di cambiare la storia naturale dei noduli tiroidei benigni in accrescimento/sintomatici, conservando l'integrità e il funzionamento del tessuto tiroideo indenne





GRAZIE PER L'ATTENZIONE