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ITALIAN CHAPTER

16° Congresso Nazionale AME

Joint Meeting with AAACE Italian Chapter

Update in Endocrinologia Clinica

9-12 novembre 2017

Roma

Radiofrequency ablation

PROGRAMMA DEFINITIVO

Maurilio Deandrea

S.C. di Endocrinologia

AO Ordine Mauriziano di Torino

Presidio Ospedaliero "Umberto I", Torino, Italia



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Conflitti di interesse



ITALIAN CHAPTER

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:

NOTHING TO DISCLOSE

Radiofrequency Ablation of Benign Cold Thyroid Nodules: Initial Clinical Experience

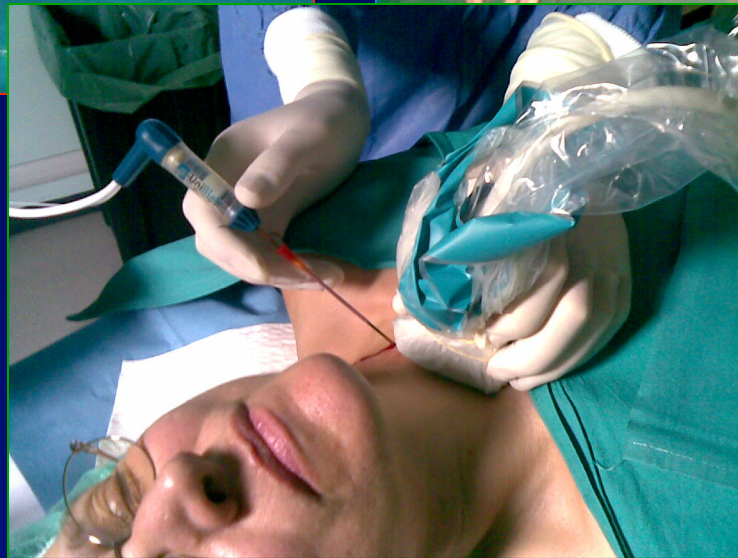
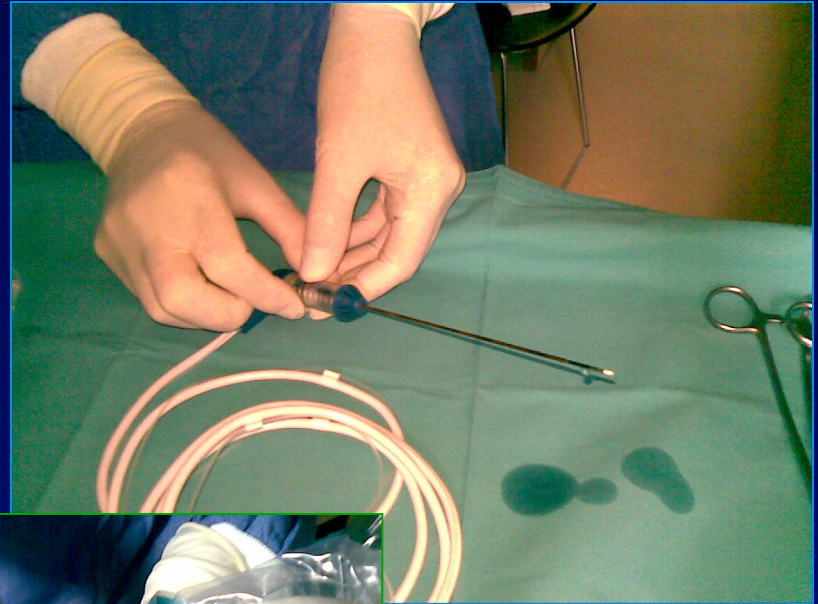
Young-Sun Kim, Hyunchul Rhim, Kyung Tae, Dong Woo Park, Sung Tae Kim

Thyroid. April 2006, Vol. 16, No. 4: 361-367

A total of 35 benign cold thyroid nodules in 30 euthyroid patients (M:F = 2:28; mean age 39.1 years) underwent percutaneous RF ablation with a 1-cm-internally cooled electrode. Seventy-seven percent (23/30) of patients required conscious sedation for discomfort. We evaluated the tumor size, cystic component, vascularity (by color Doppler US), and the severity of mass-related symptoms before treatment. We assessed the therapeutic efficacy and safety of RF ablation by clinical and US follow-up (median 6.4 months). *Main outcome and results:* The volume of the tumors before ablation had a range of 0.6–28.2 mL (mean, 6.3 mL). **The residual volume was 53.5% ± 26.5% of original at 1.1–2.9 months (n = 32), 36.2% ± 27.4% at 3.0–5.9 months (n = 20), 30.7% ± 25.0% at 6.0–8.9 months (n = 15), and 11.8% ± 10.9% at 9.0–18.5 months (n = 13)**



RTA: 14 Gauge



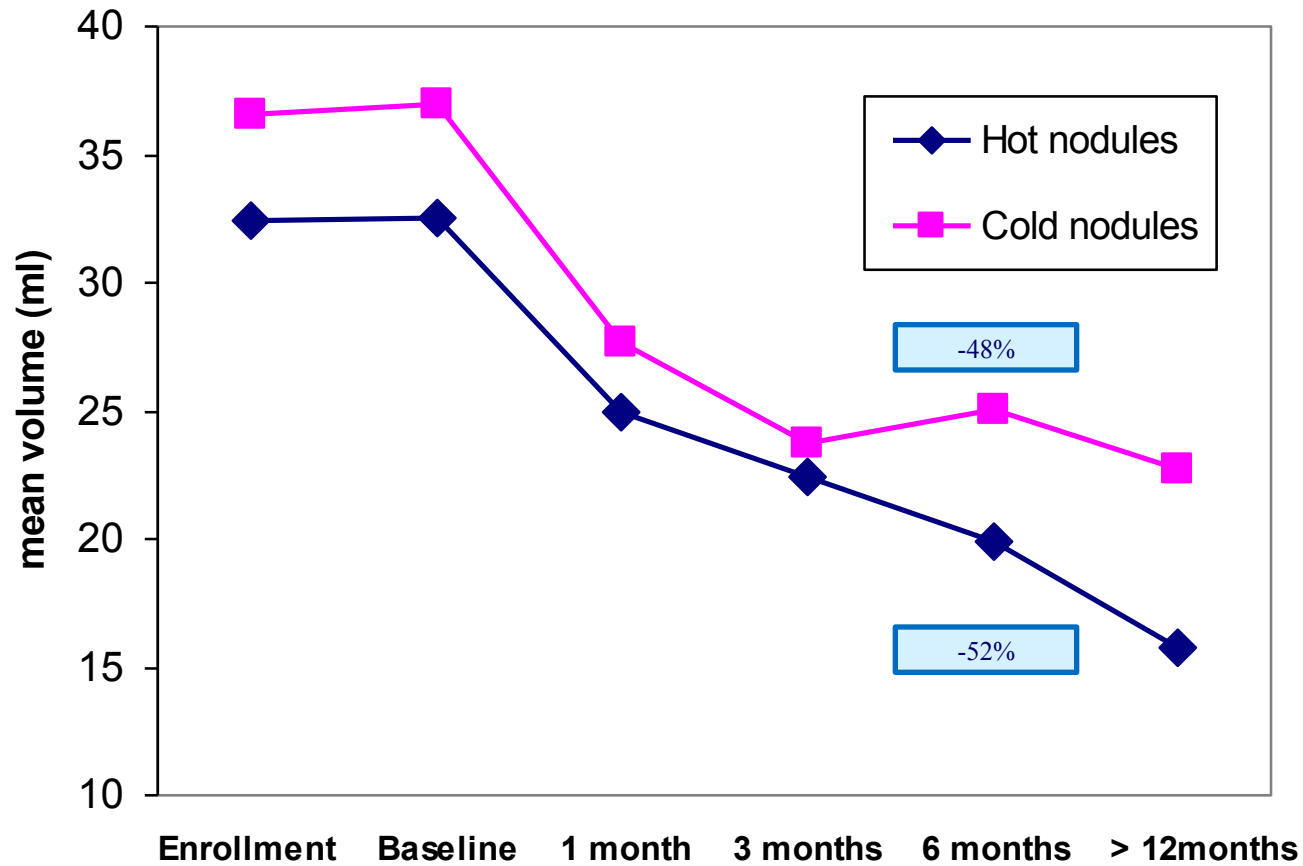
US-GUIDED PERCUTANEOUS RADIOFREQUENCY THERMAL ABLATION FOR THE TREATMENT OF SOLID BENIGN HYPERFUNCTIONING OR COMPRESSIVE THYROID NODULES

MAURILIO DEANDREA,^{*} PAOLO LIMONE,^{*} EDOARDO BASSO,^{*} ALBERTO MORMILE,^{*}
FEDERICO RAGAZZONI,^{*} ELENA GAMARRA,^{*} STEFANO SPIEZIA,[†] ANTONGIULIO FAGGIANO,[‡]
ANNAMARIA COLAO,[‡] FILIPPO MOLINARI,[§] and ROBERTO GARBEROGLIO[¶]

Ultrasound in Med. & Biol., Vol. 34, No. 5, pp. 784–791, 2008

Patients		
	Number	57
	Sex	16♂ / 41♀
	Age range	28 - 88
	Median age	63.8
Nodules		
	Number	59
	Volume min-max (ml)	2,5 / 180,2
	Volume medium ± 2 SD (ml)	34,5 \pm 31
Function		
	Cold Nodules	26
	Hot nodules	33

Volume Shrinkage



Thyroid Nodules and Related Symptoms Are Stably Controlled Two Years After Radiofrequency Thermal Ablation

Stefano Spiezia,¹ Roberto Garberoglio,² Francesco Milone,³ Valeria Ramundo,³ Corrado Caiazzo,¹ Angelo Pio Assanti,¹ Maurilio Deandrea,² Paolo P. Limone,² Paolo E. Macchia,³ Gaetano Lombardi,³ Annamaria Colao,³ and Antongiulio Faggiano³

TABLE 1. CHARACTERISTICS OF PATIENT POPULATION AND THYROID NODULES

No. of patients	94
Age (range, mean \pm SEM)	66–89, 72.5 \pm 0.5 years
Sex M/F	39/55
Thyroid nodule volume (nontoxic + toxic/pretoxic nodules)	
Mean \pm SEM	24.5 \pm 2.1 mL
Range	4.5–103 mL
Nontoxic thyroid nodule volume	
Mean \pm SEM	21.1 \pm 1.7 mL
Range	4.5–73.2 mL
Toxic and pretoxic thyroid nodule volume	
Mean \pm SEM	32.7 \pm 5.4 mL
Range	5.3–103 mL

2008 The “moving – shot technique”



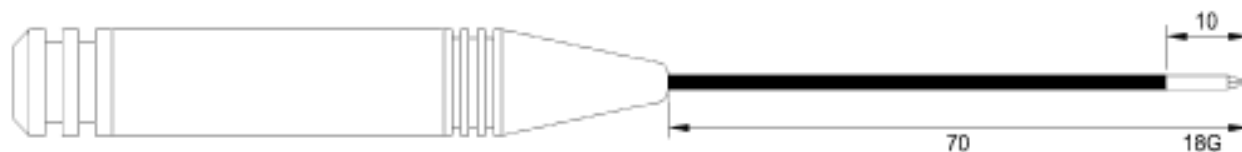
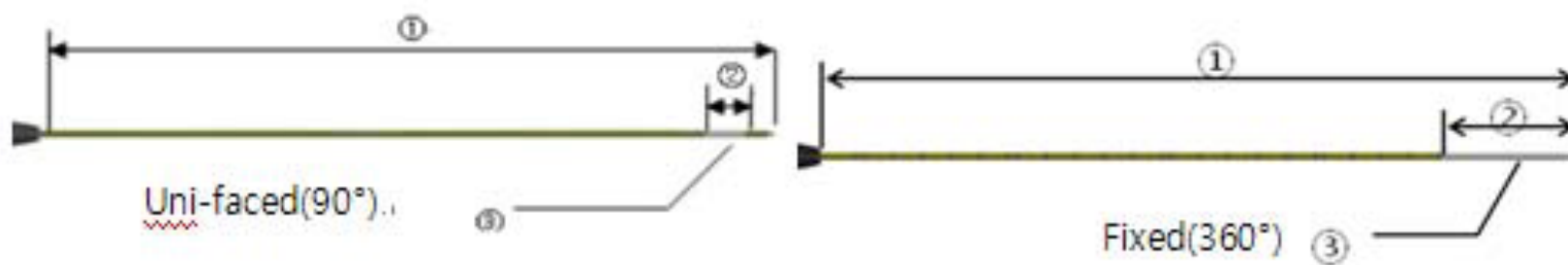
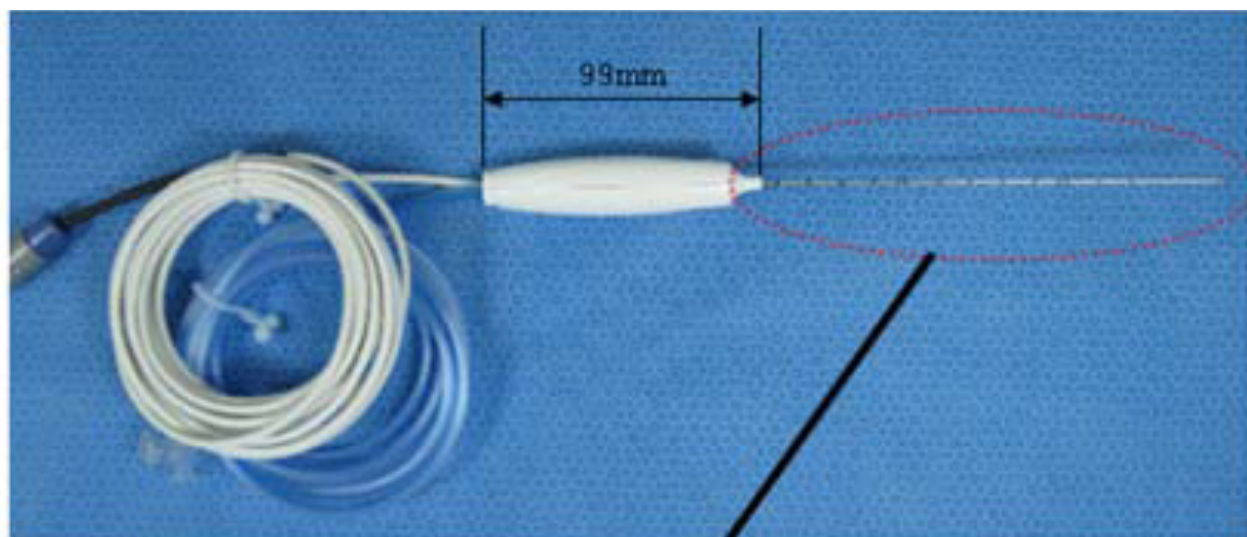


Fig. 1 Modified internally cooled electrode for thyroid lesion, which is shorter (7 cm shaft length) and thinner (18G) than conventional electrode



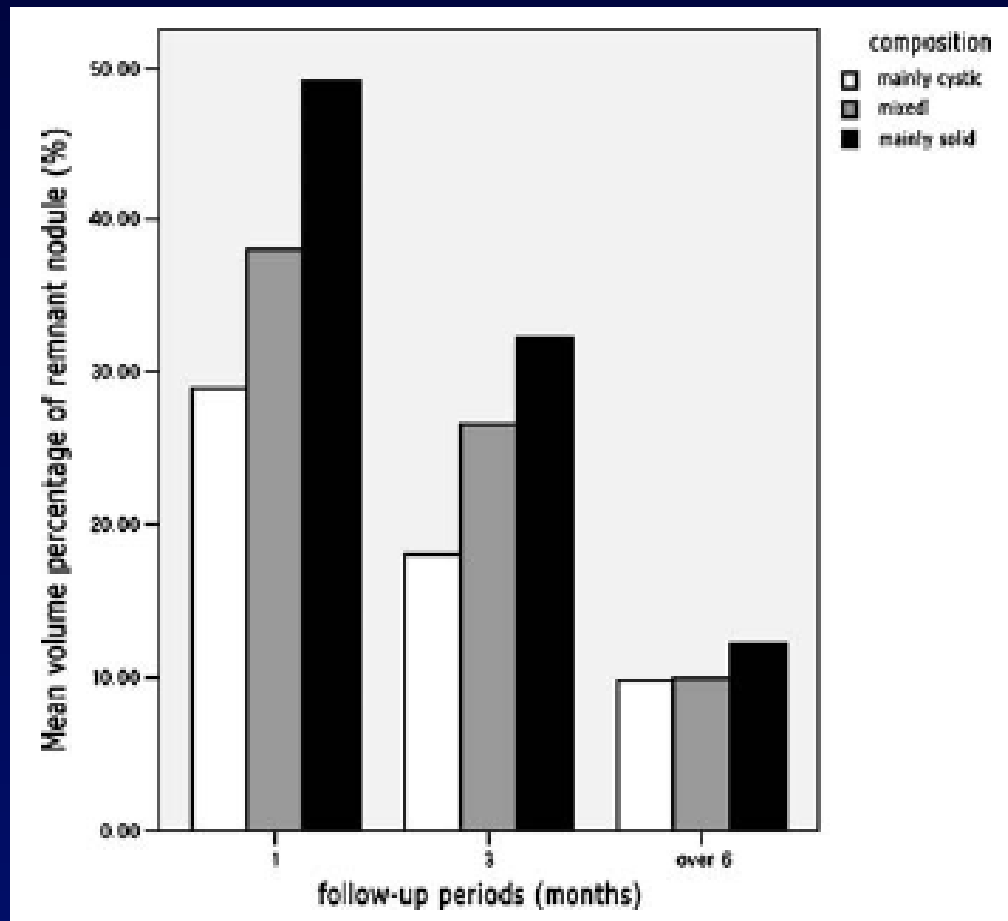
Woo Kyoung Jeong
Jung Hwan Baek
Hyunchul Rhim
Yoon Suk Kim
Min Sook Kwak
Hyun Jo Jeong
Ducky Lee

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

Table 1 The changes in volume before RFA and at each follow-up

	Initial	1 month later	3 months later	6 months later	Last follow-up
No. of nodules	302	247	155	140	302
Volume (ml) ^a	0.11–95.61 (6.13±9.59)	0.00–40.30 (2.53±4.40)	0.00–24.17 (2.00±3.24)	0.00–30.11 (1.54±4.38)	0.00–26.07 (1.12±2.92)
Largest diameter (cm) ^a	0.6–10.00 (2.44±1.36)	0.00–7.00 (1.73±1.03)	0.00–5.20 (1.60±0.97)	0.00–6.00 (1.26±1.07)	0.00–5.70 (1.01±1.00)
Volume reduction rate (%)		58.20	74.41	84.79	84.11

^aMean ±standard deviation *in parentheses*



Conclusion

Thyroid nodule RFA appears safe and imaging follow-up confirms volume reduction, however its efficacy and safety needs to be verified through long-term follow-up.

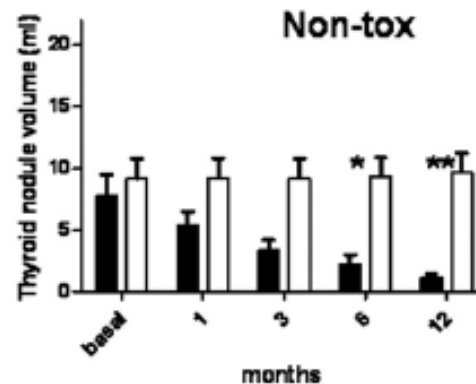
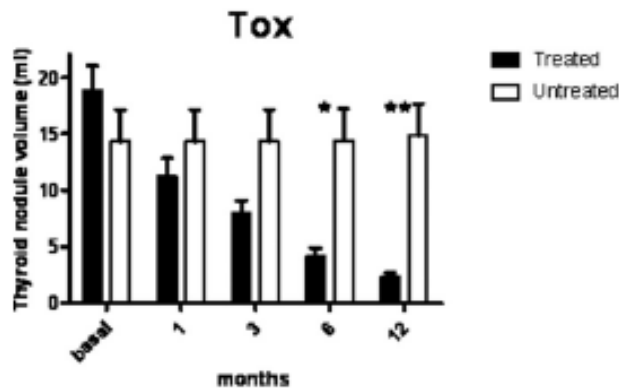
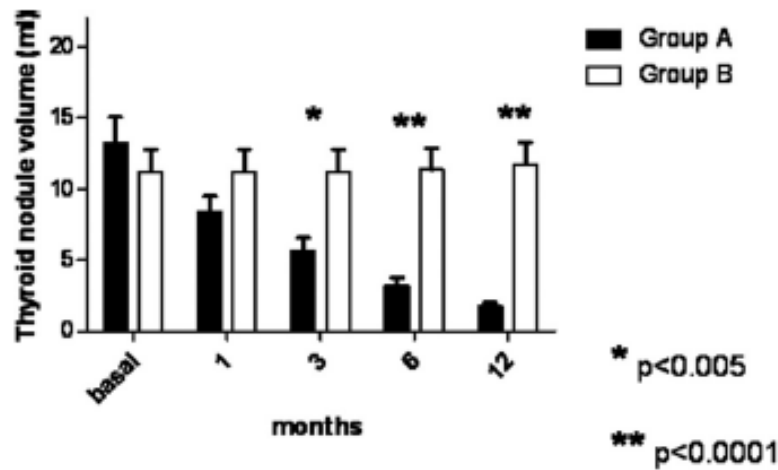
Thyroid Nodules Treated with Percutaneous Radiofrequency Thermal Ablation: A Comparative Study

A. Faggiano, V. Ramundo, A. P. Assanti, F. Fonderico, P. E. Macchia, C. Misso, F. Marciello, V. Marotta, M. Del Prete, E. Papini, G. Lombardi, A. Colao, and S. Spiezia

J Clin Endocrinol Metab, December 2012, 97(12):4439–4445

TABLE 1. Baseline characteristics of patients with TNs

Parameter	Group A	Group B	P
n	20	20	NS
Sex (males/females)	4/16	5/15	NS
Age in years, mean \pm SEM (range)	58.3 \pm 4.3 (31–86)	62.1 \pm 3.1 (36–85)	NS
TN volume (ml)			
Mean \pm SEM	13.3 \pm 1.8	11.2 \pm 1.5	NS
Median	12.35	7.7	
Range	4–27.9	3.6–25.8	
Patients with nontoxic TNs (n)	10	12	NS
Patients with toxic TNs (n)	10	8	NS
SYS score (range)	3.4 \pm 0.3 (1–5)	3.0 \pm 0.3 (1–5)	NS



Nodule volume

After treatment, TN volume significantly decreased in group A (8.3 ± 1.2 ml at 1 month, 5.7 ± 0.9 ml at 3 months, 3.2 ± 0.6 ml at 6 months, and 1.8 ± 0.3 ml at 12 months; $P < 0.0001$), whereas it remained unchanged in group B [11.2 ± 1.5 ml at 1 month, 11.3 ± 1.5 ml at 3 months, 11.4 ± 1.5 ml at 6 months, and 11.8 ± 1.5 ml at 12 months; $P = \text{not significant (NS)}$] (Fig. 1). At 3-, 6-, and

Thyroid ultrasound (US) and US-assisted procedures: from the shadows into an array of applications

EJE 2014

Enrico Papini^{1,†}, Claudio M Pacella² and Laszlo Hegedus³

Table 3 Clinical outcomes of patients with symptomatic benign thyroid nodules treated with radiofrequency ablation.

Author	Pts/ nodule no	RCT	US pattern cystic-solid	Fluid com- ponent (%)	Baseline (vol. ml mean) hot/cold	Nodule function hot/cold no	Electrode type	Energy load (J/ml mean)	Number of session (mean)	FU mo	Volume reduction (% mean) hot/cold
Kim <i>et al.</i> (2006) (56) ^a	30/35		Cystic-solid	> 80	6.3	Cold	17G cooled electrode		1	6.4 (median)	88
Spiezia <i>et al.</i> (2007) (111)	39/39		Solid			Cold	14G multined electrodes		1.4	6	74
Jeong <i>et al.</i> (2008) (109) ^b	236/302		Cystic-solid	> 80	6.1	Cold	17G cooled electrode		1.4	6	85
Baek <i>et al.</i> (2008) (110)	1		Mixed		5.1	Hot	17G cooled electrode			19	97
Deandrea <i>et al.</i> (2008) (115) ^c	33/33		Cystic-solid	< 30	22.6/39.3	23/10	14G multined electrodes		1	6	52 vs 46
Spiezia <i>et al.</i> (2009) (116) ^c	94/94		Cystic-solid	< 30	32.7/21.1	28/66	14G multined electrodes		1 (median)	12	78
Baek <i>et al.</i> (2009) (112)	9/9		Cystic-solid	> 80	14.9	Hot	17–18G cooled electrode	10 818	2.2	6	71
Baek <i>et al.</i> (2010) (113)	15 vs 15		Cystic-solid	> 50	6.9/7.5	Cold	18G cooled electrode	4966	1	6	80
Sung <i>et al.</i> (2011) (120) ^d	21		Cystic	> 90	10.2	Cold	18G cooled electrode		1.7	6	> 50
Huh <i>et al.</i> (2012) (114) ^e	15 vs 15	Yes	Cystic-solid	> 50	13.3/13.0	Cold	18G cooled electrode	4377 vs 6157	1	6	70 vs 78
Faggiano <i>et al.</i> (2012) (117) ^c	20/20		Cystic-solid	< 30	11.2/13.3	10/10	14G multined electrodes		1	9	85
Lim <i>et al.</i> (2013) (118) ^f	111/126		Cystic-solid	65	9.8	Cold	17/18G cooled electrode	2936	2.2	49	93
Sung <i>et al.</i> (2013) (121) ^g	25 vs 25	Yes	Cystic	> 90	9.3	Cold	18G cooled electrode		1	6	93

Pts, patients.

^aSixteen of 35 (45.7%) nodules were mainly cystic with cystic portion > 80%.

^bFifty-four percent with solid portion > 80%, 16% with cystic component > 80%, and remaining 30% with mixed structure.

^cUniformly solid (100% solid) or predominantly solid with not more than 30% fluid component.

^dTherapeutic success defined as volume reduction > 50 was achieved with RFA in 20/21 (95%) nodules.

^eOne RF session vs two RF sessions.

^fForty-five nodules with solid component ≤ 50% and 81 nodules with solid component > 50%.

^gRCT: RFA vs PEIT.

Efficacy and Safety of Radiofrequency Ablation Versus Observation for Nonfunctioning Benign Thyroid Nodules: A Randomized Controlled International Collaborative Trial

Maurilio Deandrea,¹ Jin Yong Sung,² Paolo Limone,¹ Alberto Mormile,¹ Francesca Garino,¹ Federico Ragazzoni,¹ Kyu Sun Kim,² Ducky Lee,³ and Jung Hwan Baek⁴

Prospective randomized trial to assess RF ablation efficacy in the treatment of compressive benign thyroid nodules

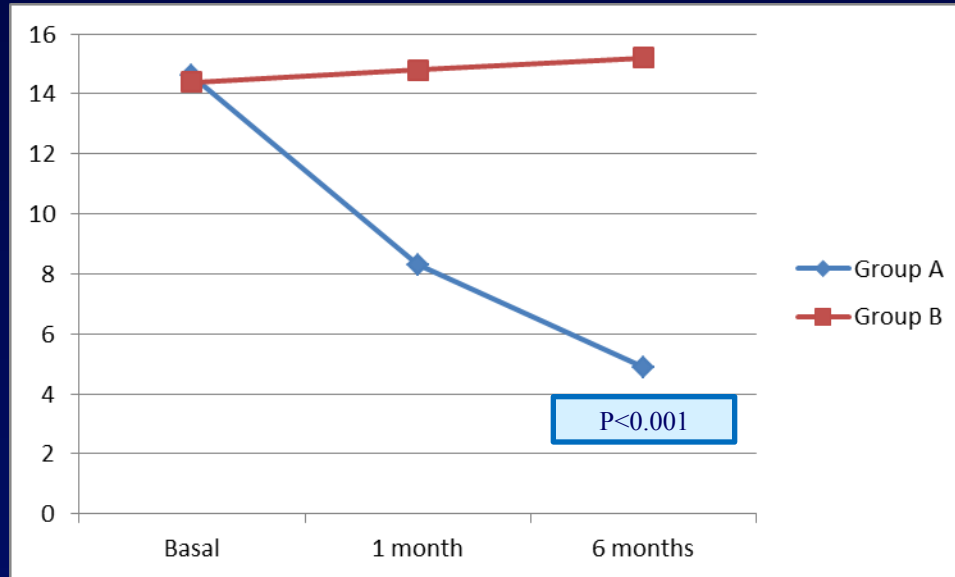
For this aim we selected a group of **benign nonfunctioning medium sized thyroid nodules** randomized to observation versus a single session of RFA

We applied the **moving-shot technique** in Italy and Korea centers to compare results in groups with large experience in radiofrequency thermal ablation.

Results: patients and energy delivered

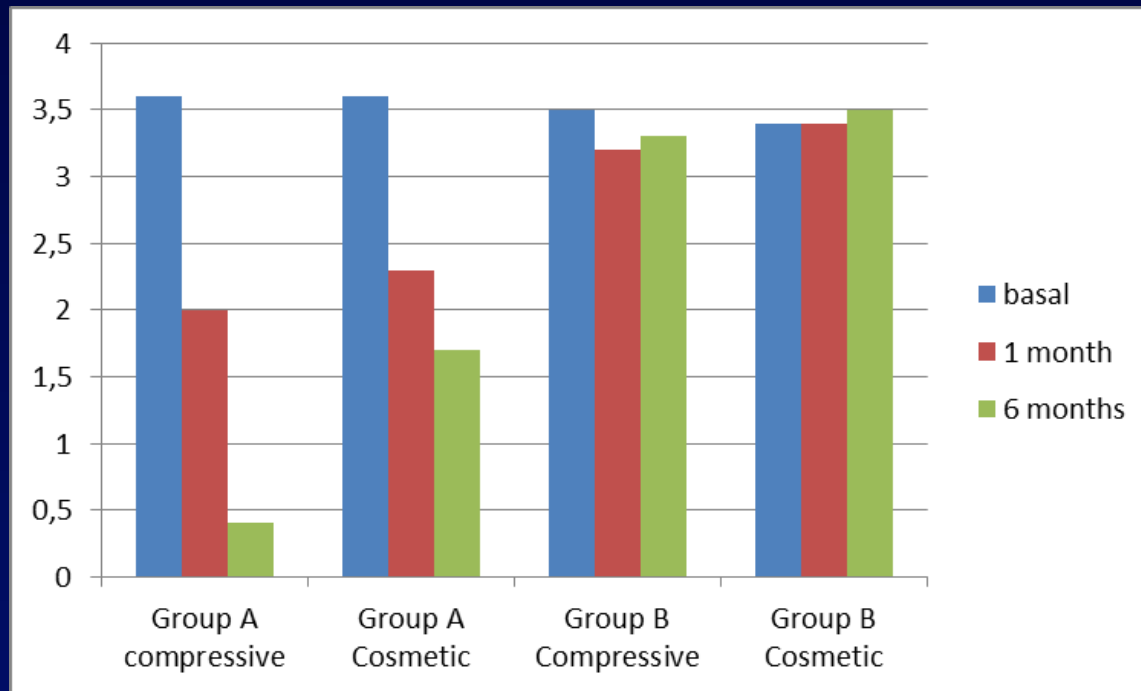
	Korea	Italy		P
Females/Males	36/4	34/6		NS
Age	39,5±9,5	56,5±14,2		0,06
Ablation time	7,2±2,3	14,2±3,5		0,03
RF Power	75,2±10,4	50,3±5,1		0,05
Energy/ml	40,6±15,2	43,6±12,7		NS
Thyroid function	normal	normal		
Complications	none	none		NS

Results: volume reduction



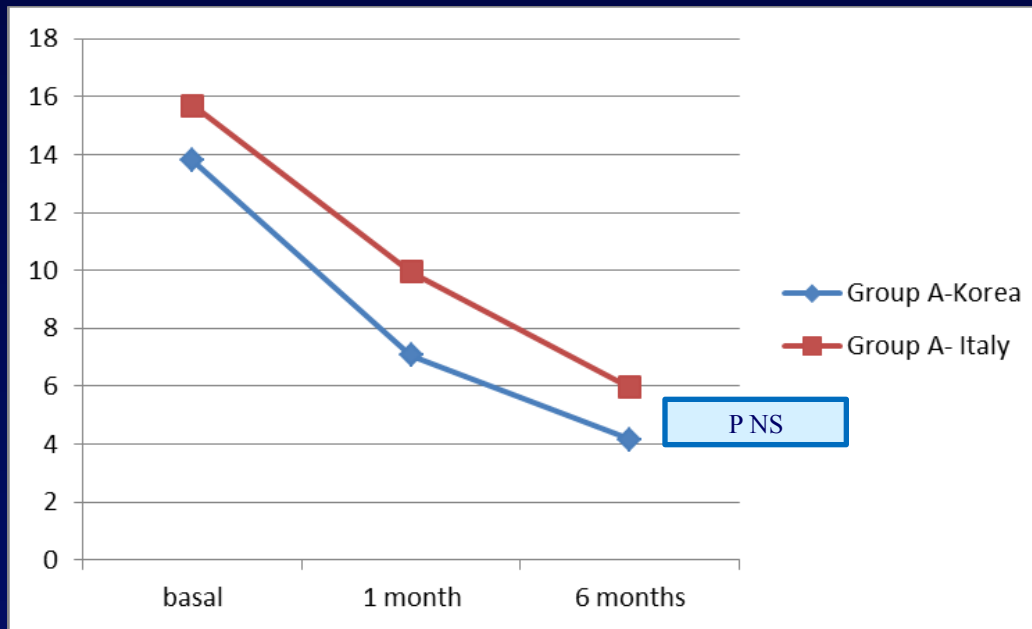
	Group A Volume (mean±SD)	% Volume	Group B Volume (mean±SD)	% Volume
Basal	14,6±3,1	-	14,4±3,3	-
1 month	8,3±2,9	- 43%	14,8±3,5	+2,7%
6 months	4,9±2,7	- 66,4%	15,2±3,5	+5,5%

Results: aesthetic/compressive symptoms



	Group A Compressive	Group A Cosmetic	Group B Compressive	Group B Cosmetic
Basal	3,6±1,9	3,6±0,5	3,5±1,7	3,4±0,7
1 month	2,0±1,7	2,3±0,7	3,2±1,9	3,4±0,9
6 months	0,4±0,7	1,7±0,8	3,3±1,7	3,5±0,7

Volume reduction: different countries



	Group A- Korea Vol (mean±SD)	Volume reduction	Group A – Italy Vol (mean±SD)	Volume reduction
Basal	13,8±3,3	-	15,9±2,5	-
1 month	7,0±2,6	47%	9,9±2,7	39%
6 months	4,1±2,9	69%	5,9±2,2	65%

RESULTS ACCORDING TO DIFFERENT SIZE

Prospective Study of Effectiveness of Ultrasound-Guided Radiofrequency Ablation Versus Control Group in Patients Affected by Benign Thyroid Nodules

Roberto Cesareo, Valerio Pasqualini, Carla Simeoni, Marco Sacchi, Erminio Saralli, Giuseppe Campagna, and Roberto Cianni

J Clin Endocrinol Metab, February 2015, 100(2):460–466

Table 2. TN Volume (Milliliters) in RFA Group

	Baseline	1 Month	6 Months
Whole group (n = 42)			
TN volume	24.5 ± 19.6	17.5 ± 34.7 ^a	8.6 ± 9.5 ^a
TN volume variation, %		-49.7 ± 14.5	-68.6 ± 13.5
Small (n = 10)			
TN volume	7.4 ± 2.7	3 ± 1.2 ^b	1.6 ± 1 ^b
TN volume variation, %		-57.5 ± 8.6	-78.2 ± 10.7
Medium (n = 21)			
TN volume	18.1 ± 4.4	9.3 ± 3 ^a	5.9 ± 2.5 ^a
TN volume variation, %		-47 ± 15	-67 ± 12.2
Large (n = 11)			
TN volume	52.3 ± 17.5	27.8 ± 13.7 ^c	20.1 ± 12.1 ^b
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.

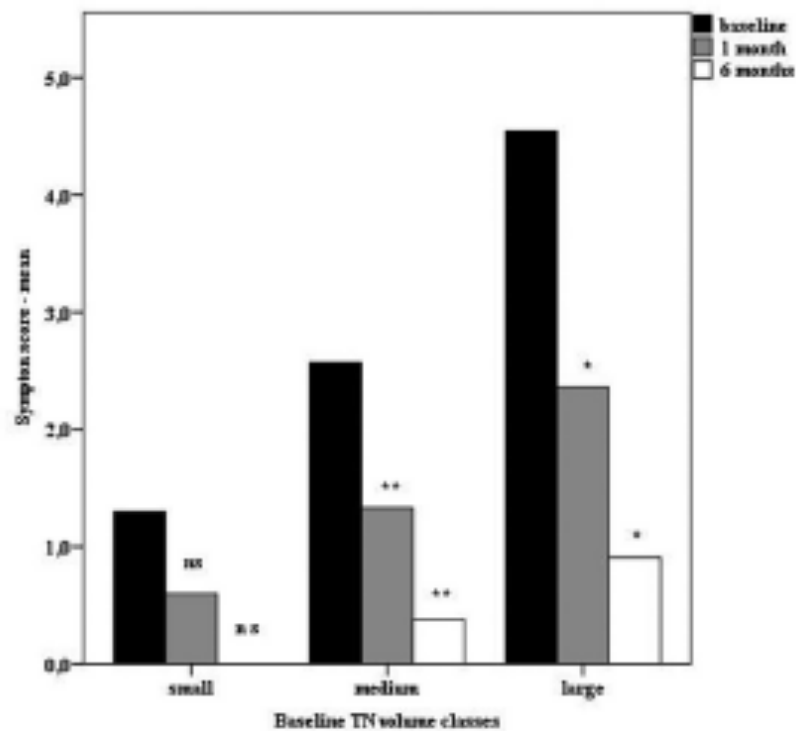


Figure 1. Pressure symptoms score in all subgroups at 1 month and at 6 months vs baseline. ns, not significant. *, $P \leq .05$; **, $P < .01$.

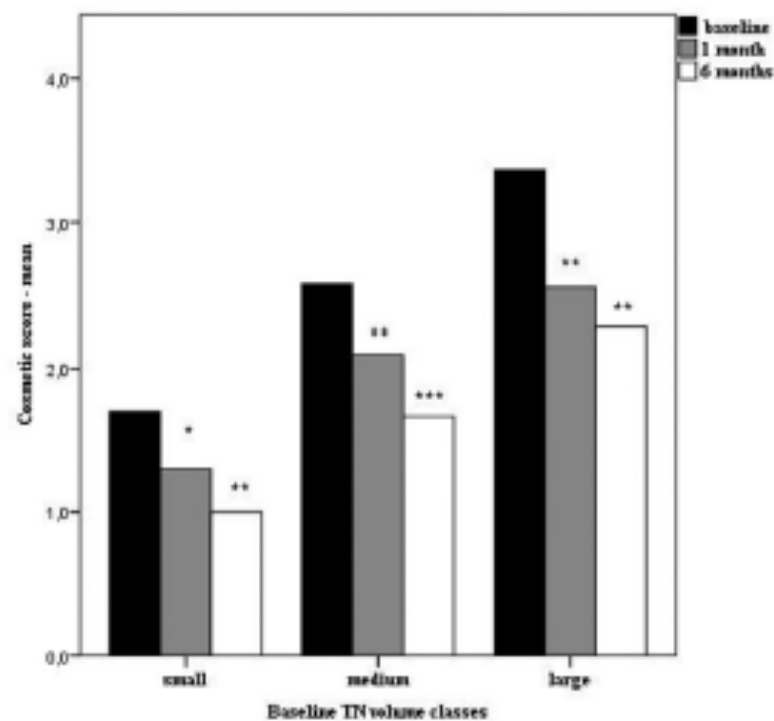
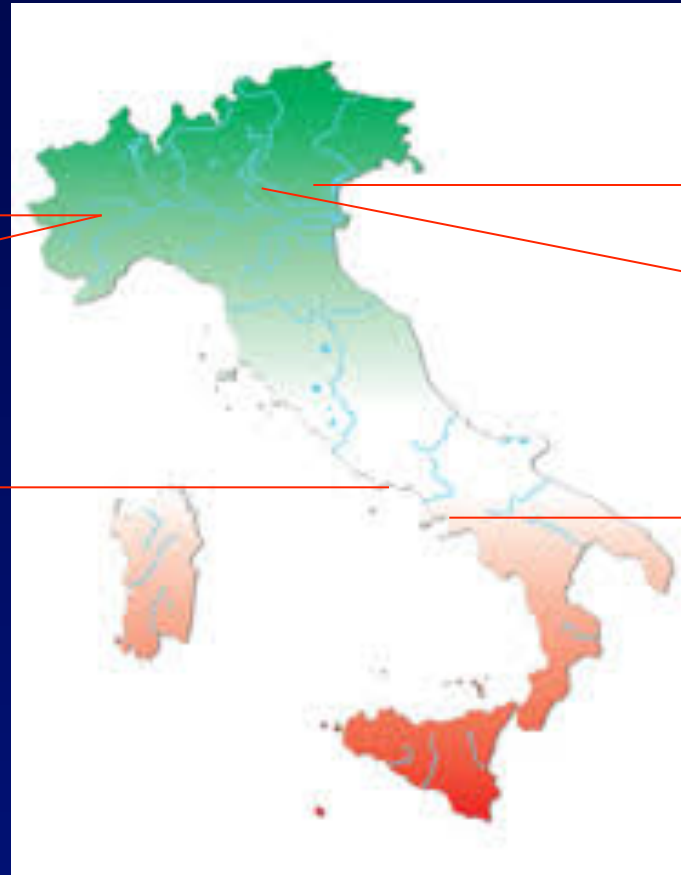


Figure 2. Cosmetic score in all groups at 1 month and at 6 months vs baseline. *, $P \leq .05$; **, $P < .01$; ***, $P < .001$.

RADIOFREQUENCY THERMAL ABLATION FOR BENIGN THYROID NODULES: RESULTS FROM AN ITALIAN MULTICENTER STUDY



Torino Mauriziano

Torino Molinette

Roma

Treviso - Venezia

Verona

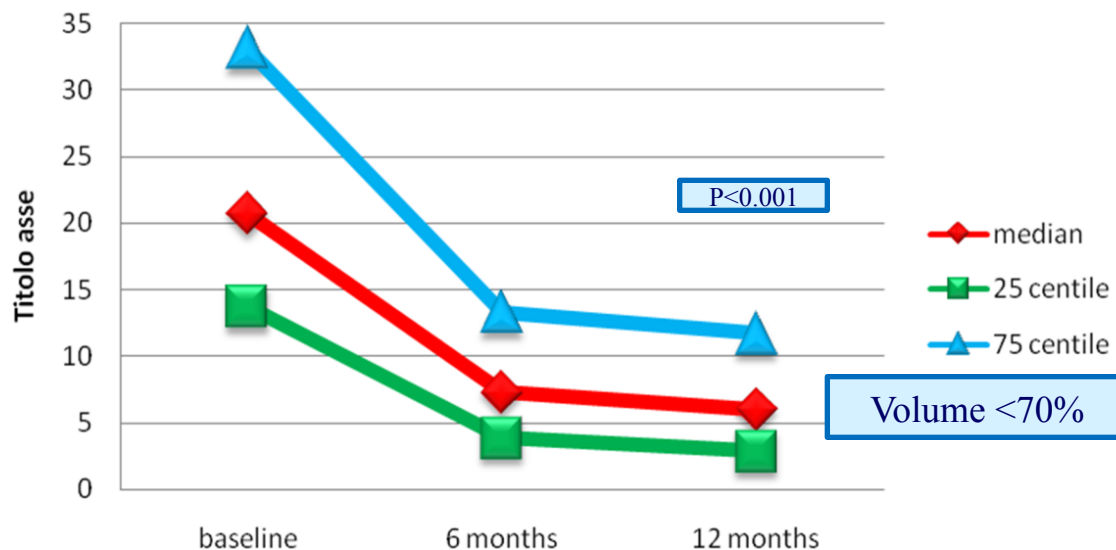
Napoli

STUDY OBJECTIVES

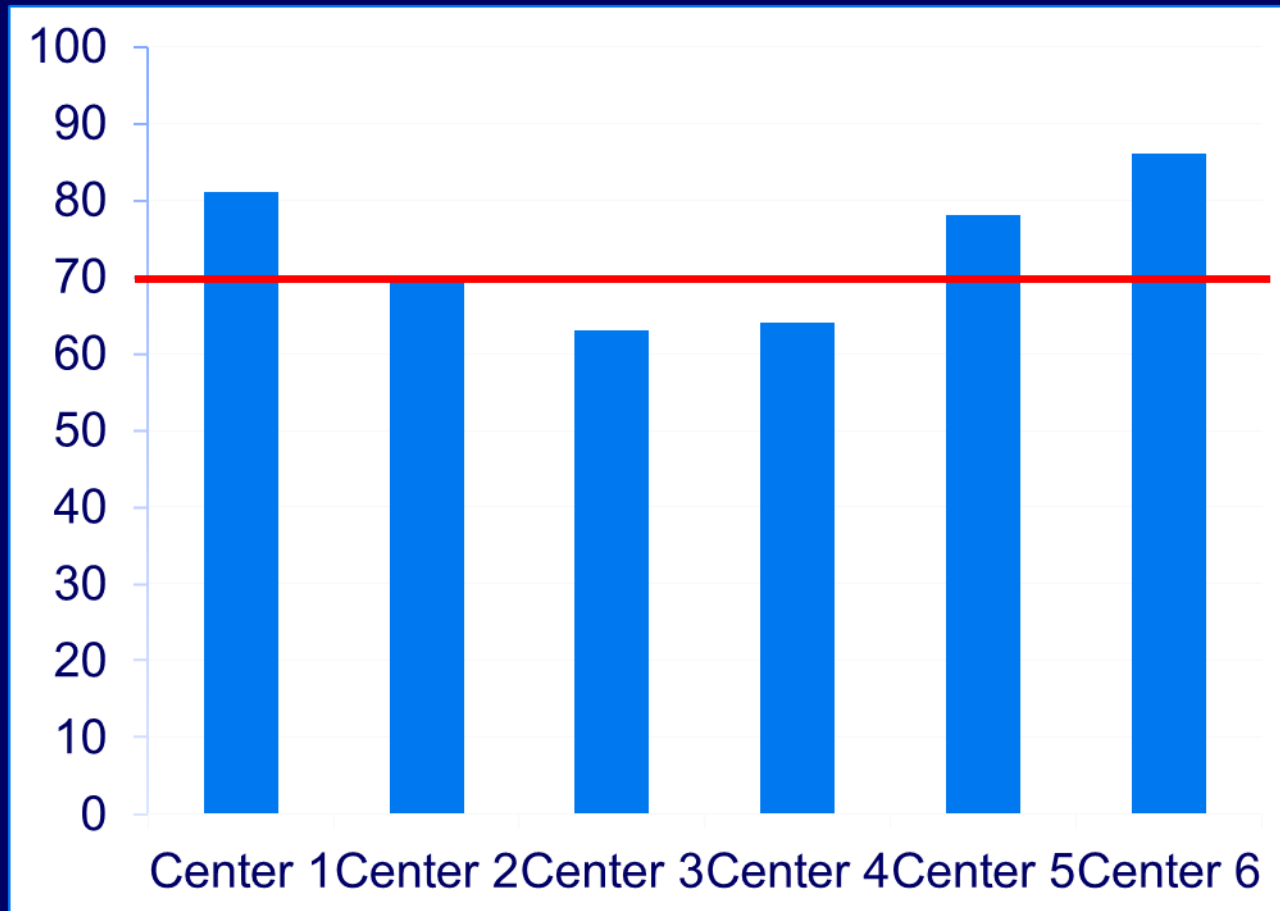
1. Assessment of nodules' reduction after one session of RF thermal ablation of benign solid thyroid nodule consecutively treated from 2014 to 2016 in different centers in Italy with different experience in moving-shot technique
2. Correlation between nodule shrinkage after RF and basal echostructure, nodule vascularity and presence of macrocalcification (escluded Egg-shell types)
3. Correlation between nodule shrinkage after RF and basal volume

Number of patients	337
Female (%)	76
Age (years) [IQR]	55 [40-73]
TSH (mIU/l) [IQR]	1,2 [0,5-2]
FT4 (pg/ml) [IQR]	1 [0,8-1,3]
AbTPO + (%)	24
Baseline volume [IQR]	20,7 [13,7-33,1]
Energy (Watt)	55 [50-62]
Time (min)	10 [7-15]

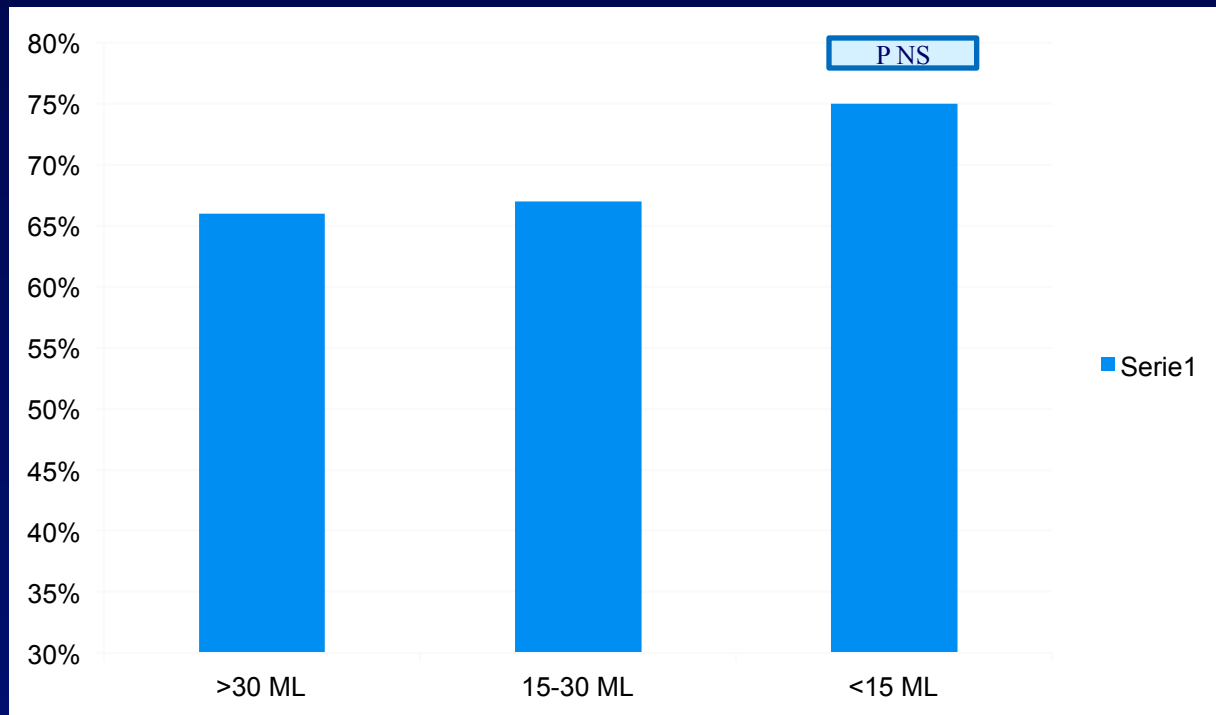
Nodule volume by time



RESULTS IN DIFFERENT CENTERS

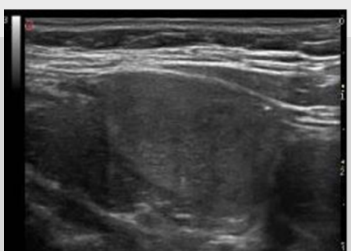
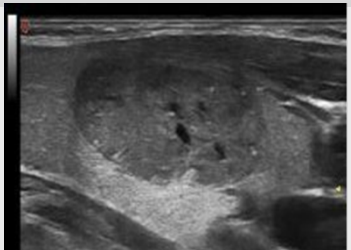
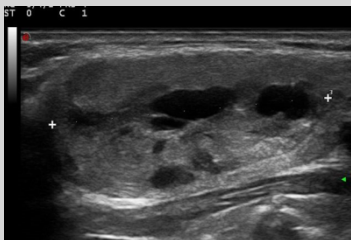


NODULES' REDUCTION and BASAL VOLUME

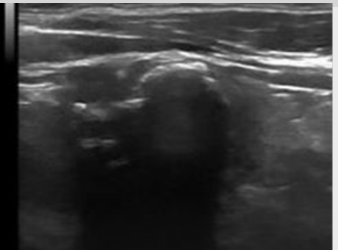
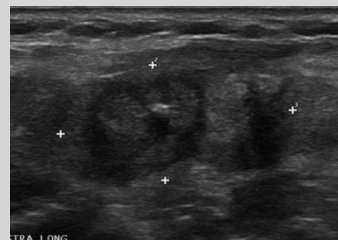


No difference in energy delivered/ml in different groups

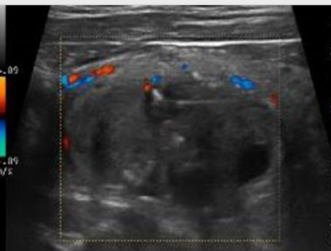
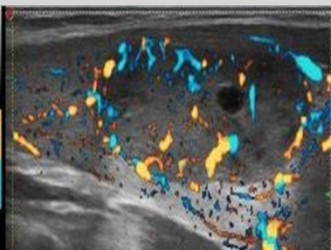
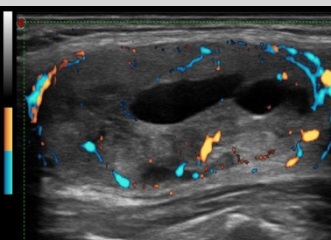
US echostructure



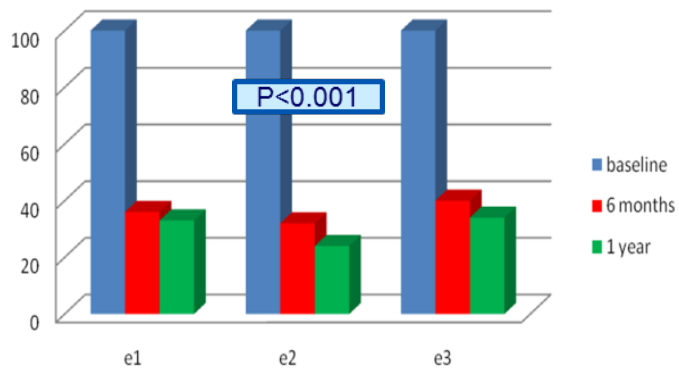
Macrocalcifications



US vascular pattern

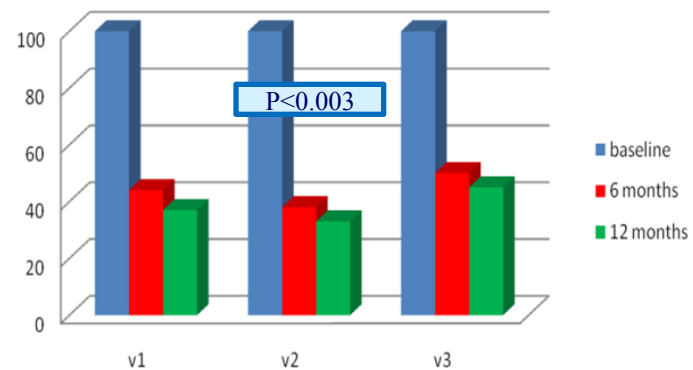


Nodule shrinkage by US structure



↑
PNS

Nodule shrinkage by US vascular pattern



COMPLICATIONS

DEGREE	TYPE	number	Recovery time (day)	%
Major	Voice change	1	3-7	0,4
	Nodule infection	1	30	
Minor	Edema	20	0,2	15
	Superficial ematoma	25	7	
	Muscle ematoma	7	14	
Side effects	Pain	42	Intraoperatively	13
	Cough	1	Intraoperatively	
	Fever	2	1 day	
Permanent	complications			0

Summary of Published Data on Complications of RF Ablation in Patients with Benign Thyroid Nodules

Study	No. of Patients	Hematoma	Skin Burn	Pain	Transient Hyperthyroidism	Hypothyroidism	Edema	Fever	Voice Change
Kim et al (9), 2006	30	1	1	1	3	...	...	...	1
Jeong et al (8), 2008	236	5	...	13	3	...	...	...	3
Deandrea et al (20), 2008*	31	...	...	Few	...	...	3	...	...
Spiezia et al (19), 2009*	94	...	...	13	...	...	...	5	...
Baek et al (7), 2009*	9	...	...	...	...	1	...	...	...
Baek et al (10), 2010	15	...	...	...	...	...	...	...	...
Lee et al (11), 2010	27	1	...	...	...	...	...	...	...
Total	442	7	1	27+Few	6	1	3	5	4

* Including autonomously functioning thyroid nodules.

Table 2. Complications and Side Effects in 1531 Patients Who Underwent LA of Thyroid Nodules

Type of complications (SIR class) ¹			Complications and Side effects no. (%) ²				
			Time of Detection				Time to Recovery (days)
			Intra-operatively	Immediate post-operative (within 24 h)	Peri-procedural (within 30 days)	Delayed (after 30 days)	
Major	Voice change	(C)		8 (0.5)*		2-84	
Minor	Hematoma	(B)		8 (0.4)		2-10	
	Skin burn	(B)		1 (0.1)		10	
Side Effects							
	Pain	(A)					
	mild		194 (10.6)	61 (3.3)		1	
	moderate		30 (1.6)	34 (1.9)		1-2	
	severe			4 (0.2)		2-3	
	Vascular reaction	(A)	12 (0.7)				
	Cough	(A)	1 (0.1)				
	Fever (37.5 C-38.5 C)	(A)		141 (7.7)		1-4	

¹ Society of Interventional Radiology (SIR) guidelines criteria(24); ² value calculated per LA sessions; * detected in nodules with large volume >30 ml

LONG TERM RESULTS

Eur Radiol

DOI 10.1007/s00330-012-2671-3

HEAD AND NECK

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

Hyun Kyung Lim · Jeong Hyun Lee · Eun Ju Ha ·
Jin Young Sung · Jae Kyun Kim · Jung Hwan Baek

Results The mean follow-up duration was 49.4 ± 13.6 months. Thyroid nodule volume decreased significantly, from 9.8 ± 8.5 ml before ablation to 0.9 ± 3.3 ml ($P < 0.001$) at final evaluation: a mean volume reduction of 93.4 ± 11.7 %. The mean cosmetic ($P < 0.001$) and symptom scores ($P < 0.001$) improved significantly. Factors related to efficacy were initial solidity and volume. The overall recurrence rate was 5.6 % (7/126). The overall complication rate was 3.6 % (4/111).

126 benign cold nodules

Volume <10ml (min diameter >20mm)

Recurrence 5.6%

Complications 3.6%

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

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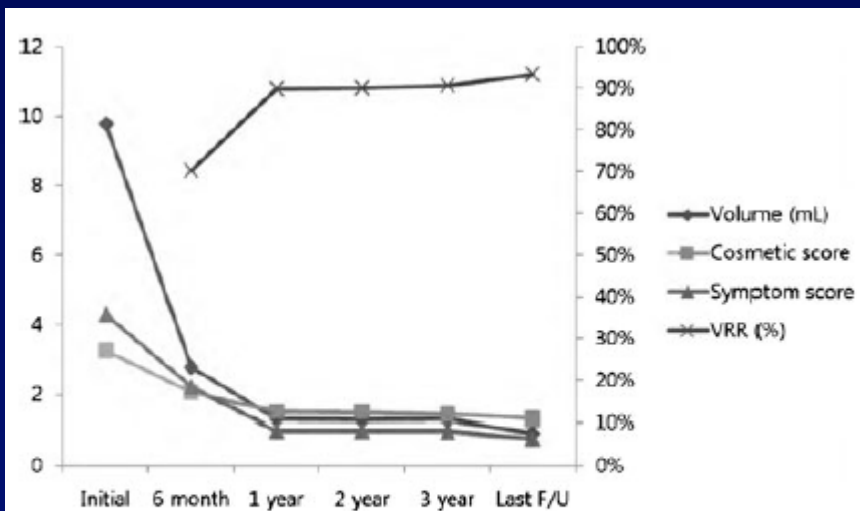


Fig. 1 Changes of thyroid nodule volume, cosmetic score, symptom score and volume reduction ratio (VRR) before RF ablation and at each follow-up

	1 year	2 years	3 years
Total	89.9±10.2	90.1±10.1	90.7±15.8
<i>P</i> value	> 0.999	< 0.001	< 0.001
Solidity ≤ 50 %	93.6±8.8	93.1±8.9	92.0±20.3
Solidity > 50 %	87.8±10.4	88.4±10.4	90.0±13.0
<i>P</i> value	0.003	0.021	0.002

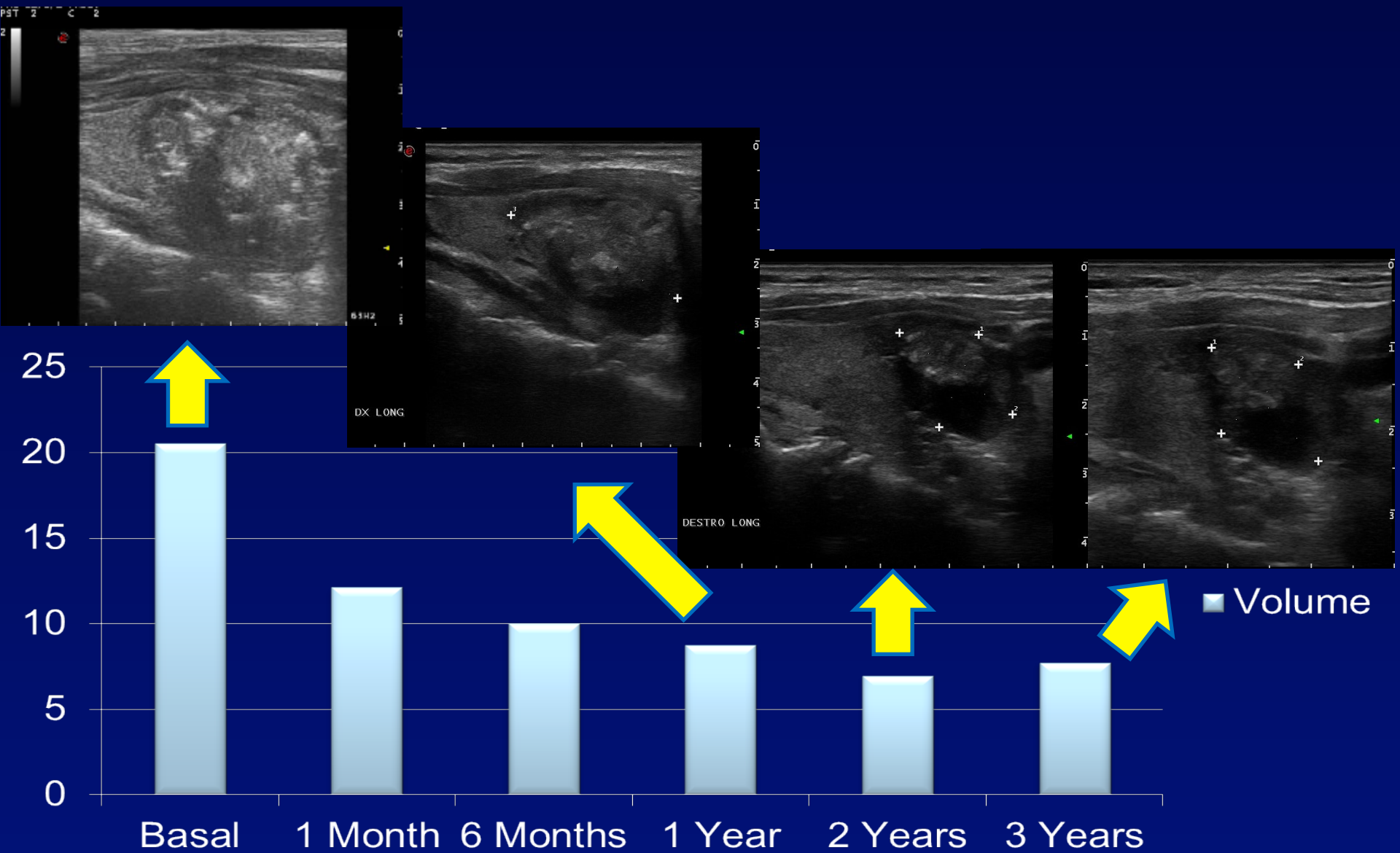
Mauriziano Hospital experience (87 pts, 3 yrs follow-up)

Volume



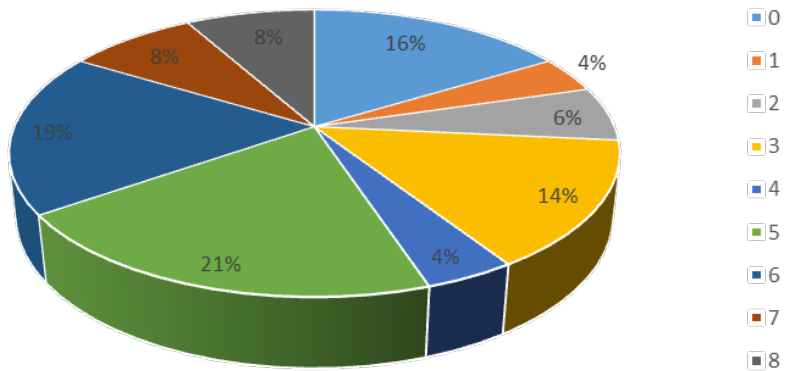
	Basal	1 Month	6 Months	1 Year	2 Years	3 Years
Volume ml	20,5	12,1	10	8,7	6,9	7,7
% reduction		-40%	-51	57,5	66,3	63

Results: volume reduction

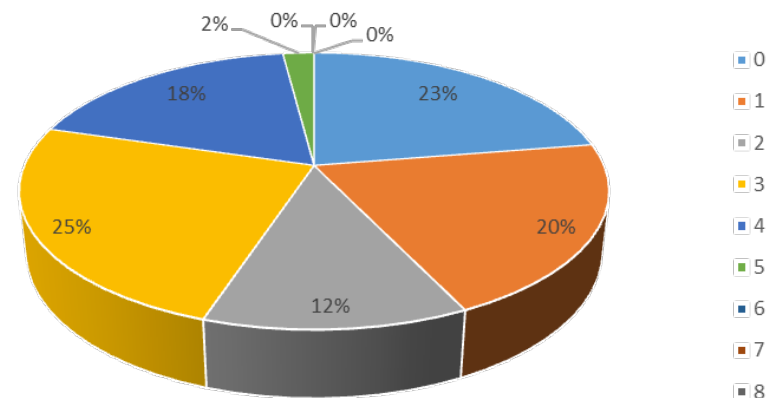


Results: compressive symptoms

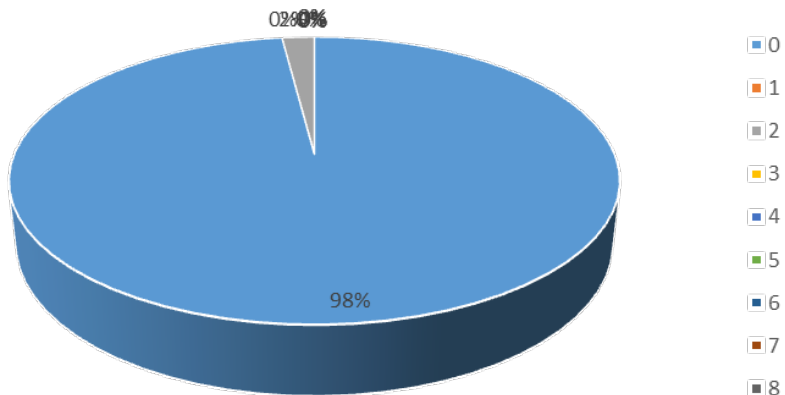
basal



6 months

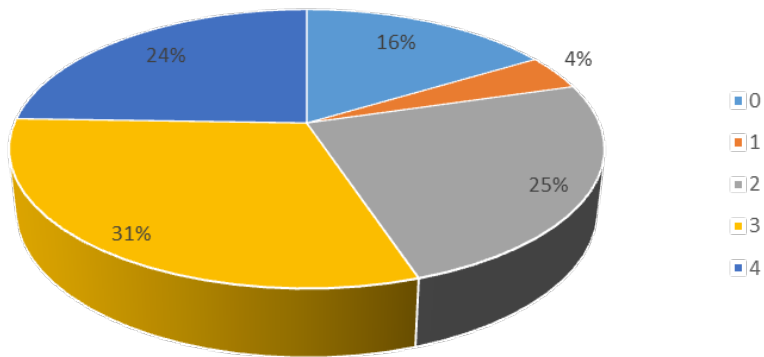


3 years

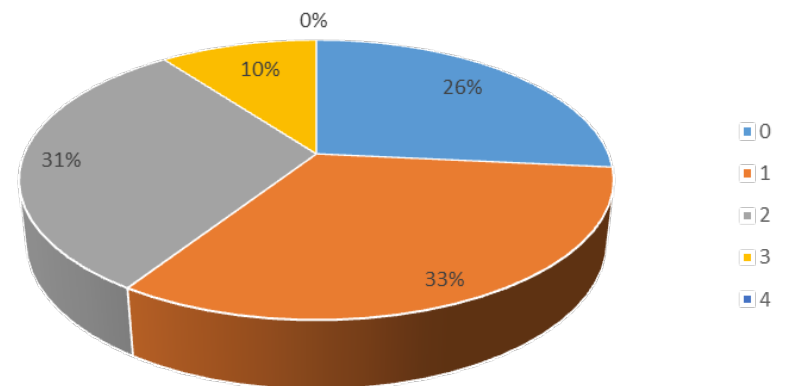


Results: aesthetic symptoms

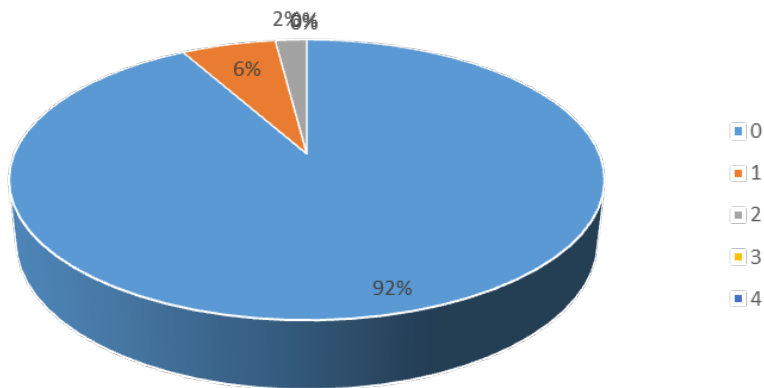
basal



6 months



3 years



STATEMENT

AACE/ACE/AME Guidelines

**AMERICAN ASSOCIATION OF CLINICAL ENDOCRINOLOGISTS,
AMERICAN COLLEGE OF ENDOCRINOLOGY, AND
ASSOCIAZIONE MEDICI ENDOCRINOLOGI MEDICAL GUIDELINES FOR
CLINICAL PRACTICE FOR THE DIAGNOSIS AND MANAGEMENT OF
THYROID NODULES – 2016 UPDATE
*EXECUTIVE SUMMARY OF RECOMMENDATIONS***

Percutaneous radiofrequency thermal ablation (RFA) is currently considered an effective tool for the management of benign thyroid nodules

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].

CONCLUSIONS

Scientific data confirm the overall efficacy of RF ablation for treating compressive benign thyroid nodules

Therapeutic efficacy is maintained during follow-up

Some US-findings easily detectable before treatment can predict final shrinkage

RF ablation can be considered a safe and effective alternative to surgery for the treatment of compressive benign thyroid nodules

Acknowledgements



Thanks for your attention

Stefano De Rosa
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