

# Percutaneous Ethanol Injection Treatment, Novel Solution for the Challenge of Recurrent Thyroid Pathology: A Review

Parisha Bhatia<sup>1</sup>, Tatyana E. Fontenot<sup>2</sup>, Koji Tsumagari<sup>1</sup>, Emad Kandil<sup>1,2\*</sup>

<sup>1</sup>Department of Surgery, Tulane University School of Medicine. New Orleans, LA, USA

<sup>2</sup>Department of Otolaryngology, Tulane University School of Medicine. New Orleans, LA, USA

\*Corresponding author: Emad Kandil, Department of Otolaryngology, Tulane Otolaryngology-Head & Neck Surgery 1430 Tulane Avenue, SL 59, New Orleans, LA 70112, USA, Tel: 504-988-5454; Fax: 504-988-7846; E-mail: [ekandil@tulane.edu](mailto:ekandil@tulane.edu)

Rec date: Mar 22, 2014, Acc date: Apr 26, 2014, Pub date: Apr 28, 2014

Copyright: © 2014 Kandil E, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

## Abstract

**Introduction:** Thyroid nodules are among the most common endocrine complaints in the United States. With increasing incidence of differentiated thyroid carcinoma there has been a widespread interest in development of minimally invasive treatments such as percutaneous ethanol injection (PEI) to manage thyroid pathology. In our review of published literatures, we discuss the application of ethanol injection for treatment of benign thyroid nodules and its efficacy in treating locally recurrent papillary thyroid carcinoma.

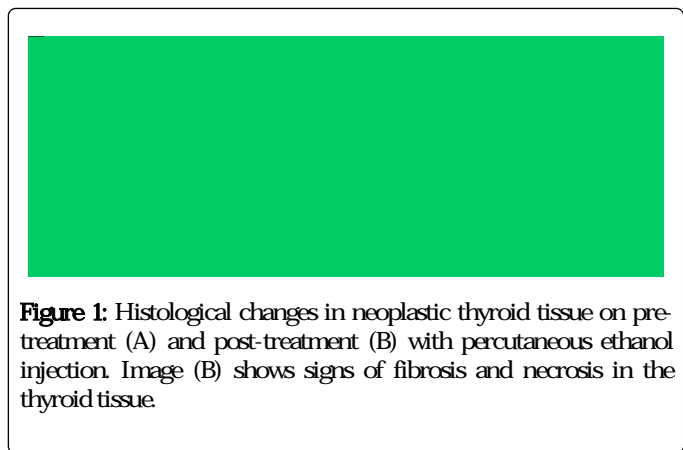
**Evolving treatment roles of PEI:** PEI has been most successful at treating recurrent cystic nodules. In hyper-functioning nodules, PEI is indicated for patients who are poor surgical and radioiodine surM]M  
pprncno]A

Kanotra et al. [37]	2008	India	Prospective	40	85
Kim YJ et al. [38]	2012	Korea	Retrospective	217	90.3

**Table 2** Studies evaluating percutaneous ethanol treatment in cystic thyroid nodules

However, many recur and surgical removal will be considered for these mostly benign cystic nodules and solid functional nodules [10]. Thyroid surgery is safe however, there is associated risk of complications even in hands of high volume surgeons and presents a significant financial burden [8]. Therefore, PEI treatment presents an attractive minimally invasive option for these patients with benign nodules. In these patients, complete and lasting disappearance of the treated cystic nodules is a realistic goal of therapy.

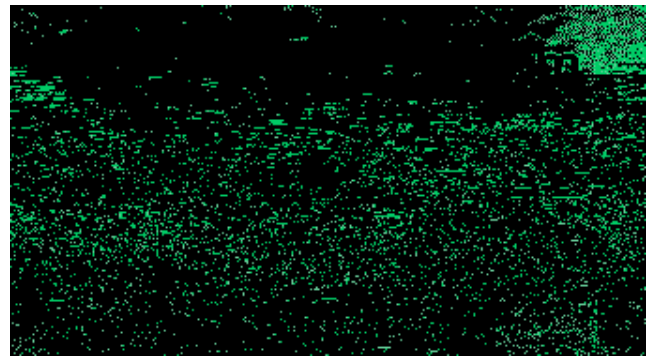
Radioactive iodine (RAI) therapy was preferred for treating hyperthyroid state. RAI is usually well tolerated but it can be associated with risks of hematologic abnormalities, reproductive disturbances, and salivary-gland disturbances with repeated doses [11]. In a recent publication, it was concluded that RAI was associated with an over 20% failure rate to treat hyperthyroid state while surgical intervention was 344 times more successful than RAI [12]. On the other hand, PEI may be a good treatment option for patients with small functional nodules (<5ml) who defer I-131 therapy and are poor surgical candidates [8]. The injection of ethanol acts by immediate tissue dehydration, protein denaturation, and coagulation necrosis of the vascular endothelium, platelet aggregation, vascular thrombosis and ischemic tissue necrosis (Figure 1) [8,10]. In currently published cases, ablation of the autonomous lesion was followed by return of normal thyroid function nearly 100% of these patients [6,7]. The possibility of subclinical or overt hyperthyroidism necessitates continued follow up with endocrinologist and serum thyroid function testing in the presence of clinical suspicion [6,7]. Despite evidence of some benefit, realistically, therapeutic role of PEI treatment of frankly toxic thyroid nodules is limited [8].



**Figure 1:** Histological changes in neoplastic thyroid tissue on pre-treatment (A) and post-treatment (B) with percutaneous ethanol injection. Image (B) shows signs of fibrosis and necrosis in the thyroid tissue

While PEI treatment for benign thyroid lesions was the area of initial sustained interest, during 2000s only investigators in Europe and Asia continued to pursue this line of application. Their colleagues in United States have instead focused on the possibility of using this treatment modality in thyroid malignancy, most commonly, PTC. PTC has one of the highest long term survival rates of any malignancy, with 90% survival at 10 years after the initial diagnosis [13,14].

However, as the other thyroid pathologies discussed in this review, it too shares the propensity to recur. Many patients who initially present with an early Stage 1 lesion must return to the operating room for treatment of their local nodal metastases multiple times after their primary operation [13,15,16]. Lobectomy or total thyroidectomy with selective cervical lymph node dissection of the affected regional nodes is the appropriate primary treatment options for PTC. Surgical interventions can be followed by radioactive Iodine-131 ablation of any remaining microscopic and macroscopic disease. In the hands of an experienced surgeon, primary total thyroidectomy has become a relatively low risk surgical procedure with a reported 2% risk of recurrent laryngeal nerve (RLN) injury [15,17,18]. Patients are monitored with ultrasound (US) routine examination for nodes suspicious for neoplastic spread (Figure 2,3). Metastatic lymph nodes are treated with selective neck lymph node dissection during primary thyroid surgery or focused dissection aimed at resecting lymph nodes missed during the initial neck dissection for the disease [15]. Prophylactic lymph node dissection has not been shown to offer a clinically significant benefit in the setting of early Stage 1 PTC to merit routine implementation [19,20]. Ironically, these patients who are most likely to suffer the cycle of local recurrence and reoperation.



**Figure 2** Ultrasound image of a sub-centimeter metastatic lymph node exhibiting loss of fatty hilum and eggshell calcifications.

thyroid  
tumor  
90%  
Malignant  
evidence

complicated  
recurrence  
Malignant  
examination  
clinical

The potential of PEI treatment in PTC was recognized early and a

effective in treating cystic thyroid nodules, non-functioning nodules, autonomous thyroid adenomas and small lesions of locally recurrent PTC.

## Conclusion

To summarize, PEA is a versatile, minimally invasive option that is well tolerated with no lasting adverse effects. It is a safer and more economically attractive option compared to conventional surgical intervention. Future prospective multi-institutional studies are warranted to further compare the oncological outcomes related this approach and re-operative neck surgery.

## References

1. Veselka J, Tomašovič P, Zemánek D (2011) Long-term effects of varying alcohol dosing in percutaneous septal ablation for obstructive hypertrophic cardiomyopathy: a randomized study with a follow-up up to 11 years. *Can J Cardiol* 27: 763-767.
2. Shiina S, Tateishi R, Imamura M, Teratani T, Koike Y, et al. (2012) Percutaneous ethanol injection for hepatocellular carcinoma: 20-year outcome and prognostic factors. *Liver Int* 32: 1434-1442.
3. Veldman MW, Reading CC, Farrell MA, Mullan BP, Wermers RA, et al. (2008) Percutaneous parathyroid ethanol ablation in patients with multiple endocrine neoplasia type 1. *AJR Am J Roentgenol* 191: 1740-1744.
4. Livraghi T, Paracchi A, Ferrari C, Bergonzi M, Garavaglia G, et al. (1990) Treatment of autonomous thyroid nodules with percutaneous ethanol injection: preliminary results. *Work in progress. Radiology* 175: 827-829.
5. Del Prete S, Caraglia M, Russo D, Vitale G, Giuberti G, et al. (2002) Percutaneous ethanol injection efficacy in the treatment of large symptomatic thyroid cystic nodules: ten-year follow-up of a large series. *Thyroid* 12: 815-821.
6. Anđjelković Z, Kuzmić-Janković S, Pucar D, Tavcar I, Dragović T (2011) Possibilities of nontoxic autonomous thyroid nodules treatment by percutaneous ethanol injection. *Vojnosanit Pregl* 68: 767-773.
7. Monzani F, Caraccio N, Goletti O, Lippolis PV, Casolaro A, et al. (1997) Five-year follow-up of percutaneous ethanol injection for the treatment of hyperfunctioning thyroid nodules: a study of 117 patients. *Clin Endocrinol (Oxf)* 46: 9-15.
8. Guglielmi R, Pacella CM, Bianchini A, Bizzarri G, Rinaldi R, et al. (2004) Percutaneous ethanol injection treatment in benign thyroid lesions: role and efficacy. *Thyroid* 14: 125-131.
9. Yoon HM, Baek JH, Lee JH, Ha EJ, Kim JK, et al. (2014) Combination therapy consisting of ethanol and radiofrequency ablation for predominantly cystic thyroid nodules. *AJNR Am J Neuroradiol* 35: 582-586.
10. Bennedbaek FN, Hegedüs L (1999) Percutaneous ethanol injection therapy in benign solitary solid cold thyroid nodules: a randomized trial comparing one injection with three injections. *Thyroid* 9: 225-233.
11. Padovani RP, Tuttle RM, Grewal R, Larson SM, Boucai L (2013) Complete blood counts are frequently abnormal one year after dosimetry guided radioactive iodine therapy for metastatic thyroid cancer. *Endocr Pract* 14:1-26.
12. Genovese BM, Noureldine SI, Gleeson EM, Tufano RP, Kandil E (2013) What is the best definitive treatment for Graves' disease? A systematic review of the existing literature. *Ann Surg Oncol* 20: 660-667.
13. Tufano RP, Bishop J, Wu G (2012) Reoperative central compartment dissection for patients with recurrent/persistent papillary thyroid cancer: efficacy, safety, and the association of the BRAF mutation. *Laryngoscope* 122:1634-40.
14. Monchik JM, Donatini G, Iannuccilli J, Dupuy DE (2006) Radiofrequency ablation and percutaneous ethanol injection treatment of thyroid nodules: a systematic review. *Thyroid* 16: 1005-1011.

34. Kim DW (2014) Usefulness of Two-Stage Ethanol Ablation in the Treatment of Benign, Predominantly Cystic Thyroid Nodules. *Endocr Pract*.
35. HS, Kim DW, Choo HJ, Jung SJ, Kang T, et al. (2014) Ethanol ablation of benign thyroid cysts and predominantly cystic thyroid nodules: factors that predict outcome. *Endocrine* 46: 107-113.
36. Sung JY, Baek JH, Kim KS, Lee D, Yoo H, et al. (2013) Single-session treatment of benign cystic thyroid nodules with ethanol versus radiofrequency ablation: a prospective randomized study. *Radiology* 269: 293-300.
37. Kanotra SP, Lateef M, Kirmani O (2008) Non-surgical management of benign thyroid cysts: use of ultrasound-guided ethanol ablation. *Postgrad Med J* 84: 639-643.
38. Kim YJ, Baek JH, Ha EJ, Lim HK, Lee JH, et al. (2012) Cystic versus predominantly cystic thyroid nodules: efficacy of ethanol ablation and analysis of related factors. *Eur Radiol* 22: 1573-1578.
39. Lewis BD, Hay ID, Charboneau JW, McIver B, Reading CC, et al. (2002) Percutaneous ethanol injection for treatment of cervical lymph node metastases in patients with papillary thyroid carcinoma. *AJR Am J Roentgenol* 178: 699-704.