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Clinical Research Article

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Long-Term Results of Treating With Ethanol Ablation 15 Adult Patients With cT1aN0 Papillary Thyroid Microcarcinoma

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Abbreviations: APTM, adult papillary thyroid microcarcinoma; AS, active surveillance; ATA, American Thyroid Association; CT, computed tomography; EA, ethanol ablation; NNMs, neck nodal metastases; pCCND, prophylactic central compartment dissection; PET, positron emission tomography; PTC, papillary thyroid carcinoma; PTM, papillary thyroid microcarcinoma; Tg, thyroglobulin; US, ultrasound; USGB, ultrasound-guided biopsies.

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Abstract

Background: Currently acceptable management options for patients with adult papillary thyroid microcarcinoma (APTM) range from immediate surgery, either unilateral lobectomy or bilateral lobar resection, to active surveillance (AS). An alternative minimally invasive approach, originally employed for eliminating neck nodal metastases, may be ultrasound-guided percutaneous ethanol ablation (EA). Here we present our experience of definitively treating with EA 15 patients with APTM.

Patients and Methods: During 2010 through 2017, the 15 cT1aN0M0 patients selected for EA were aged 36 to 86 years (median, 45 years). Tumor volumes (n = 17), assessed by sonography, ranged from 25 to 375 mm^3 (median, 109 mm^3). Fourteen of 15 patients had 2 ethanol injections on successive days; total volume injected ranged from 0.45 to 1.80 cc (median, 1.1 cc). All ablated patients were followed with sonography and underwent recalculation of tumor volume and reassessment of tumor perfusion at each follow-up visit.

Results: The ablated patients have now been followed for 10 to 100 months (median, 64 months). There were no complications and no ablated patient developed postprocedure recurrent laryngeal nerve dysfunction. All 17 ablated tumors shrank (median 93%) and

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Doppler flow eliminated. Median tumor volume reduction in 9 identifiable avascular foci was 82% (range, 26%-93%). After EA, 8 tumors (47%) disappeared on sonography after a median of 10 months. During follow-up no new PTM foci and no nodal metastases have been identified.

Conclusions: Definitive treatment of APTM by EA is effective, safe, and inexpensive. Our results suggest that, for APTM patients who do not wish neck surgery and are uncomfortable with AS, EA represents a well-tolerated and minimally invasive outpatient management option.

Key Words: PTC, microcarcinoma, ethanol ablation, surgery, outcome, morbidity

Papillary thyroid carcinoma (PTC) accounts globally for at least 80% to 85% of follicular cell-derived thyroid cancers [1] and, since 2000, represents as much as 88% and 93% of all thyroid malignancies diagnosed in California and Olmsted County, Minnesota [2, 3]. Papillary thyroid microcarcinoma (PTM), defined as a PTC with a maximum tumor diameter of 10 mm or less, has long been recognized to be present in 6% to 36% of autopsy studies [4, 5]. Globally, these PTMs are now being increasingly recognized in vivo [3, 6-11], in part thanks to the increasing use of high-resolution ultrasound (US), which is capable of permitting US-guided biopsies (USGB) of intrathyroidal nodules as small as 3 mm in diameter and threatens an "epidemic" [7, 8, 11] or "tsunami" [5, 12] of microcarcinomas. During 8 decades (1936-2015), at the Mayo Clinic in Rochester, Minnesota, PTM accounted for 32% of 4242 new cases of PTC in adults [13]. Moreover, analysis of the National Cancer Institute's Surveillance, Epidemiology, and End Results database has revealed that in the United States "nearly a quarter of all PTC cases are now microcarcinomas in a patient older than 45 and these patients are the main contributors to the rising incidence of PTC demonstrated in population-based studies" [6].

The present American Thyroid Association (ATA) guidelines [14] recommend that "if surgery is chosen for patients with thyroid cancer < 1 cm without extrathyroidal extension and cN0, the initial surgical procedure should be a thyroid lobectomy unless there are clear indications to remove the contralateral lobe. Thyroid lobectomy alone is sufficient treatment for small, unifocal, intrathyroidal carcinomas in the absence of prior head and neck irradiation, familial thyroid carcinoma, or clinically detectable cervical nodal metastases" [14]. The authors of these 2015 guidelines [14] recognized that for PTM an "active surveillance" (AS) management approach [15, 16] is "a safe and effective alternative to immediate surgical resection". Many [17] interpreted this as an endorsement by the ATA guidelines of AS "as an alternative to immediate thyroidectomy in properly selected patients with very low-risk tumors" [18]. Recently AS, now alternatively defined by Shaha and Tuttle as "deferred intervention" [19], has no longer being considered as "an experimental treatment option, but rather one acceptable option within the standard of care for appropriately selected persons with low-risk thyroid cancers" [20].

An alternative "minimally invasive" nonsurgical approach [21] to PTM management, pioneered in Italy [22], China [23, 24], and Korea [25], has been US-guided percutaneous ablation with laser [22], microwave [23], or radiofrequency [24, 25]. At our institution, we have since 1991 [26] favored ethanol ablation (EA) for eliminating recurrences in neck nodal metastases (NNMs) in selected patients with differentiated thyroid carcinoma [27-29]. In this manuscript, we report our long-term experience of successfully managing 17 PTM (cT1aN0) tumors employing EA as the definitive primary treatment.

1. Materials and Methods

A. Institutional Review Board Approval of Study

The study of ablated patients was approved by the Mayo Clinic Institutional Review Board, and all patients gave permission for their data to be included in the study.

B. Evaluation of Patients for Ethanol Ablation

During 2010 through 2017 all adult patients with APTM seen at the Mayo Clinic in Rochester, Minnesota, were typically managed by a staff clinical endocrinologist, usually a member of the Thyroid Interest Group. If patients were directly referred to Mayo with a PTM diagnosis, then the outside biopsy material would be requested, the samples reviewed, and the diagnosis confirmed by a Mayo staff cytopathologist. If the clinical or radiologic diagnosis was suspected at Mayo, then a USGB for the confirmation of diagnosis would be performed either by an endocrinologist or by a diagnostic radiologist. All PTM patients would have thyroid function testing at initial evaluation (thyrotropin and free thyroxine), most would have serum thyroglobulin

(Tg) and anti-Tg antibodies measured, and many would, if clinically indicated, have thyroid peroxidase antibodies checked. Most patients would have a preoperative chest x-ray performed and some had previously undergone a chest computed tomography (CT) or whole-body positron emission tomography (PET)-CT scanning elsewhere.

C. Selection of Patients for Ethanol Ablation

Even if the patient favored observation or EA, he or she would be introduced to a thyroid surgeon to discuss treatment options. All patients who were to receive EA had refused surgery offered to them either at Mayo or elsewhere prior to being evaluated in Rochester. The first 2 PTM patients, who later had EA performed, had undergone an initial period of observation after a positive USGB before deciding that they were uncomfortable with "watchful waiting" and requested a definitive treatment that was minimally invasive. In 4 cases (27%), because of significant comorbidities, the surgeon advised EA as a preferred alternative. Five (33%) patients (during 2012-2017), having initially being evaluated elsewhere, came to Mayo primarily to be considered for EA. The remaining 6 PTM patients (40%) were evaluated by the Mayo multidisciplinary team (surgeon, endocrinologist, and radiologist) and the endocrinologist, taking advantage of "shared decision-making" methods [9], concluded that the patient should consider EA. Final approval of the ablative procedure for all 15 patients came from 1 of the 2 designated interventional radiologists after careful review of the available sonograms, supplemented by personal reexamination with high-resolution sonography of the patient's neck.

D. Details of the Ethanol Ablation Procedure

All ethanol ablative procedures for APTM during 2010 to 2017 were performed by 2 radiologists (C.C.R. and R.A.L.), who by 2010 had a collective experience of 45 years at Mayo Clinic in sonography and US-guided interventions. The sonography scanner used in this study was the LOGIQ E9 (General Electric Health Care). The highest-frequency transducer permitting adequate depth penetration (typically 8-15 MHz) was employed. Each PTM focus was carefully measured and the pretreatment volume (in millimeters cubed, mm^3) was calculated using the ellipsoid formula [21] of anteroposterior X transverse X longitudinal diameters X 0.52. Color Doppler ultrasonography was performed to document presence and degree of intratumoral perfusion. The ethanol injection technique was based on the procedure used at Mayo since 1988 to treated selected parathyroid adenomas [30] and as reported initially for NNM elimination by Lewis and colleagues in 2002 [31]. The PTM patients had ablation performed soon after USGB-confirmed positive cytology; injections were typically performed in 2 sessions on successive days. The tumoral volume and vascularity of the treated PTM was documented in the first and all subsequent sonographic reports. The volume of injected 95% ethanol was decided at the time of the EA procedure by the interventional radiologist, who also recorded the injected volume at the time of each ablative session. Prior to EA, it was explained to the patient, by both the endocrinologist and the radiologist performing the ablative procedure, that a surgical approach would be the routine therapy for PTM and that high-resolution sonography could miss a level VI nodal metastasis, and that EA would likely control or eliminate the primary tumor but could not prevent the possibility of future locoregional recurrence. The radiologist obtained signed informed consent from the selected patients selected for EA before initiating the course of treatment [21].

E. Follow-up Protocol

Routinely, the PTM patients were asked to return 3 to 4 months after the initial EA sessions for a recheck examination. At that visit the patient would be assessed by the treating endocrinologist and, whenever possible, the sonographic images were carefully reviewed by the radiologist who performed the initial ablative procedure. The ablated PTM would again be carefully measured and the volume compared to the preablation value. Doppler flow would again be assessed and consideration given to the need for a further ethanol injection. In general, further injections would be considered if Doppler flow was not completely eliminated. When flow was eliminated, the maximum diameter and the volume of the ablated PTM had typically decreased. Subsequently, patients would return for reassessment 1 year after EA and thereafter, if possible, annually until stability of volumes was achieved or the ablated PTM disappeared. After disappearance of the ablated focus or volume stability in still identifiable lesions, the interval between return visits would be increased to 18 months and eventually to 24 months. At the time of latest follow-up, only 8 (7%) of the 14 surviving patients were still being followed at Mayo; the other 6 (43%), at an average of 6 years post-EA, were being followed by local physicians.

2. Results

A. Presenting Features of 15 Ablated Patients

Fifteen adult patients (10 women, 5 men) were selected by the multidisciplinary team (endocrinologist, surgeon, and radiologist) for EA of PTM at the Mayo Clinic in

Rochester during 2010 to 2017. All 15 were numbered chronologically according to their date of EA. Their ages at time of EA ranged from 36 to 86 years (median, 45 years). Initial discovery of PTM was by neck US in 9, PET-CT in 4, and CT or magnetic resonance neck imaging in 2. All had positive cytology for PTC by USGB. Two patients (cases 2 and 5) were found on Mayo presentation to have 2 foci of PTM. Concomitant nonmalignant thyroid diseases included benign nodules in 8 (53%) and autoimmune thyroid disease (2 Hashimoto and 1 Graves) in 3 (20%). Case 9 had a prior history of a lobectomy for benign disease that had revealed an incidental 2-mm PTM. Significant comorbidities were present in case 1 (advanced coronary artery disease), cases 3 and 11 (metastatic breast cancer), and case 12 (stage IIIB malignant melanoma).

Case 1 (an 86-year-old man) had severe 3-vessel coronary disease not amenable to intervention and a history of chronic lymphocytic leukemia and prostate cancer; however, he also had a symptomatic 8-cm diameter left lobar benign thyroid cyst that was twice aspirated but reaccumulated. His PTM of 8 mm diameter had been incidentally discovered in the contralateral right lobe, had positive cytology for PTC on USGB, and was kept under observation for 22 months prior to EA. At the time of ethanol sclerosis [32] of the left lobar 8.7-cm benign cyst and EA of the right lobar 8-mm PTM in February 2010, the volumes of the cystic benign nodule and the PTM were 156 757 mm^3 and 233 mm^3, respectively. His PTM was the only one in the series that received only one single injection of 0.2 cc of 95% ethanol that "was injected into multiple sites within the small calcified nodule in the right thyroid lower pole without complications". Case 2 had initially refused any treatment for his bilateral multifocal PTM, accepted a period of 22 months of observation at Mayo, and then enthusiastically endorsed becoming the first patient to receive EA for multifocal PTM. Cases 4, 5, 7, 10, and 15, who had no comorbidities and absolutely would not consider a thyroid resection or possible lifelong thyroxine therapy, traveled (4 from Europe/Asia) to Minnesota for a confirmatory consultation in the hopes of being eligible for EA. In cases 1, 3, 11, and 12, the nature of the patients' other concomitant life-threatening conditions led the surgeons to advise EA as an acceptable alternative. The remaining 6 cases (numbered as 2, 6, 8, 9, 13, and 14) underwent shared decision making [9, 33] with their endocrinologists and opted for EA as their individual choice of therapy from the array of available management strategies.

B. Details of Ethanol Ablation Treatment Sessions

Case 1 was exceptional in having only one ethanol injection. Cases 2 to 15 had 2 injections scheduled, 1 each on successive days. Three tumors (1 in case 2 and 2 in case 5) required a second treatment session after 3 months to completely eliminate Doppler flow. The maximum PTM tumor diameters (n = 17) varied between 4 and 10 mm (mean, 7 mm); calculated tumor volumes prior to EA ranged from 25 to 375 mm^3 (median, 109 mm^3). In cases 2 to 15 the volume injected on the first day ranged from 0.2 to 0.8 cc (median, 0.4 cc); the total ethanol volume injected during the 2-day first session directly into the 16 individual tumors varied between 0.45 cc and 1.8 cc (median volume, 1.1 cc).

C. Post–Ethanol Ablation Outcome in 15 Ablated Patients

All 15 patients have now been followed at Mayo for 10 to 100 months (median, 64 months). No patient developed after EA a painful thyroiditis; none had temporary or permanent hoarseness due to recurrent laryngeal nerve dysfunction. Minimal neck discomfort dissipated within hours of the EA procedure. All 17 tumor foci have shrunk (median shrinkage, 93%) after Doppler flow was completely eliminated. Nine avascular tumor foci (Fig. 1) were still identifiable at last follow-up; their tumor volumes at EA and the latest volumes measured post-EA are illustrated in Fig. 2. Follow-up in these 8 patients (case 2 with 2 foci) averaged 73 months (range, 32-100 months). Initial volumes ranged from a maximum of 375 mm^3 (8 × 10 × 9 mm) to a minimum of 31 mm^3 (3 × 4 × 4 mm). Of the 9 still identifiable foci, the tumor shrinkage (Figs. 1 and 2) varied between 26 and 93% (median, 82%). All post-EA volumes were less than 100 mm^3 and 6 were less than 50 mm^3. The smallest calculated volumes of 9 mm^3 (case 6), 9 mm^3 (case 7) and 3 mm^3 (case 15) were dependent on measuring tumor diameters as small as 1 and 2 mm; from our previous EA experiences (29), these tiny masses will likely disappear with longer follow-up.

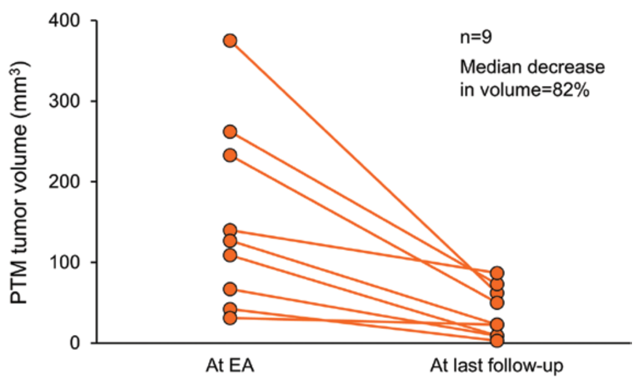

Figure 1. Decreases in volume observed after ethanol ablation (EA) in 9 still-identifiable cT1aN0M0-stable avascular ablated lesions. PTM, papillary thyroid microcarcinoma.

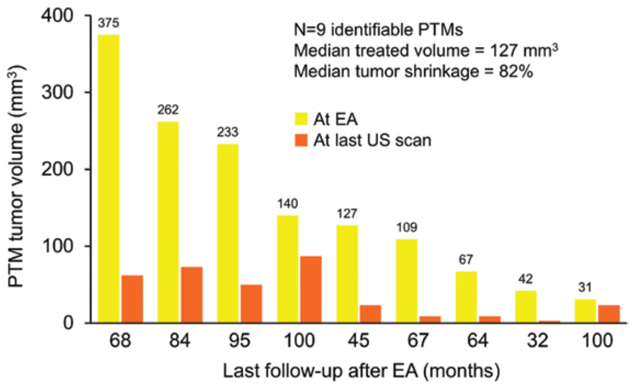

Figure 2. Papillary thyroid microcarcinoma (PTM) tumor volumes before and after ethanol ablation (EA) in 9 still-identifiable ablated lesions. The numbers above the yellow columns refer to the tumor volumes at the time of ablation. The numbers on the horizontal axis denote the numbers of follow-up months for each ablated PTM.

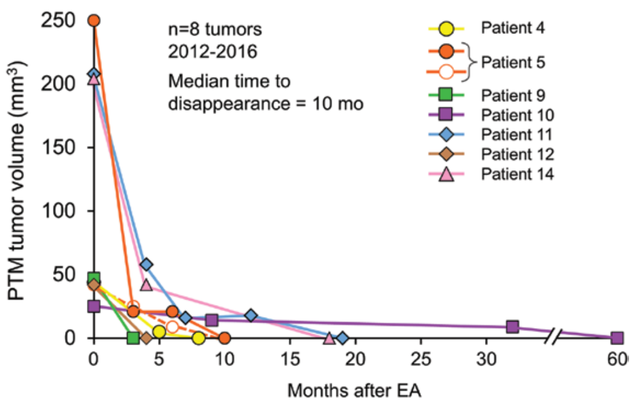

Figure 3. Serial tumor volumes from ethanol ablation (EA) to disappearance in 8 ablated papillary thyroid microcarcinoma (PTM) tumors. Six tumors were unifocal but patient 5 had 2 adjacent separate foci in the isthmus.

Fig. 3 demonstrates the serial tumor volumes in 8 tumors from 7 patients that disappeared on sonography because of 100% shrinkage. The median time to disappearance was 10 months after EA. The pre-EA tumor volumes ranged between 25 and 250 mm^3 (median, 46 mm^3). Four tumors (50%) disappeared within 1 year; 7 (87%) disappeared before 20 months. In case 10 the postablation volume was only 9 mm^3($2 \times 3 \times 3$ mm) at 32 months, but the patient was unable to return from China at 48 months and last measurements were delayed until her return at 60 months. Reliable serial serum Tg values were available for 12 patients without interfering anti-Tg antibodies. Baseline Tg values ranged from 2.5 to 26 ng/mL. None of these 12 patients showed an increase in serum Tg values during follow-up averaging 63 months. The mean serum Tg at the time of EA was 14 ng/mL, and at latest follow-up this had fallen to 9.7 ng/mL. During follow-up no ablated patient has to date developed either a further primary tumor or a novel nodal metastasis; none had a cancer-related death. Case 1 died at 95 months after EA from his worsening congestive heart failure.

3. Discussion

Whether an intrathyroidal node-negative PTM (T1aN0M0) tumor has been operated on [4, 5], ablated [21-24], or observed [15, 16], there is obviously a small but significant risk of tumor progression or recurrence after prolonged follow-up. Miyauchi from Kuma Hospital [15] made it clear from his seminal study of AS that, in his experience, by 10 years after diagnosis 8% of observed PTMs will have enlarged and 3.8% may have been found on sonography to have "novel nodal metastases." A 2019 systematic review and meta-analysis [34] of published AS studies quantitated the 5-year risks of size enlargement and lymph node metastasis at 5.3% (CI, 4.4%-6.4%) and 1.6% (CI, 1.1%-2.4%), respectively. If, as the latest ATA guidelines [14] recommend, unilateral lobectomy alone is sufficient treatment for cT1a N0M0 patients, then, like those managed by AS or ablation, whether by laser [22], microwave [23], radiofrequency [24, 25] or ethanol, the rates of tumor recurrence will be highly dependent on the availability of reliable high-quality sonography during follow-up [15, 34] and a heightened awareness of the dual possibilities [4, 5, 33] of discovering either a further focus of PTM in the remaining thyroid or an NNM, either in the central or a lateral compartment.

From our prospectively collected Mayo Clinic PTC data registry [13, 33], we know that during the same 8 years (2010-2017) when we were ablating the 15 selected patients, there were also 267 other adult PTM patients in Rochester, Minnesota, having immediate definitive surgery (unilateral lobectomy or bilateral lobar resection) for pT1aN0M0 tumors similar to those in our ablated patients. The 5- and 10-year risks for discovering in these 267 operated-on patients a further PTM focus (typically in the contralateral remnant) were both 0.9%, whereas the comparable risks for NNMs were 1.6% and 3.2%. Despite the acknowledged and considerable thyroid surgical expertise at the Mayo Clinic, 4 (2.2%) of these 267 operated patients developed either postoperative permanent unilateral cord paralysis or permanent hypoparathyroidism. After 91 unilateral lobectomy procedures there was no permanent hypocalcemia, and none of the 89 patients who had only a lobectomy (without concomitant thoracic surgery for intrathoracic nonthyroid cancer) experienced a permanent cord paralysis. By contrast, 1 patient (0.6%) of 176 undertaking bilateral lobar resection had unilateral cord paralysis and 3 (1.7%) had permanent hypoparathyroidism. One of these 3 patients had undergone a near-total thyroidectomy for a retrosternal goiter, whereas the other

2 had total thyroidectomies and prophylactic central compartment dissection (pCCND). As Boucai and colleagues [17], on behalf of the ATA Surgical Affairs Committee, have recently observed, "the high price of hypoparathyroidism or damage of the recurrent laryngeal nerve with a pCCND is not offset by any measurable oncologic advantage for the patient with a microcarcinoma", a statement with which we would certainly agree.

Ito and colleagues from Kuma Hospital have stated that "the costs of surgery and active surveillance vary from country to country, but active surveillance is more cost-effective than immediate surgery (at least in Japan and Hong Kong). It is unlikely that surgery is much more cost-effective than observation in any country" [35]. By contrast, Lin and colleagues at the University of Sydney [36] recently reported that the "estimated cost of surgical papillary thyroid microcarcinoma treatment was equivalent to the cost of 16.2 years of active surveillance" and concluded that "surgery may have a long-term economic advantage for younger Australian patients with papillary thyroid microcarcinoma who are likely to require more than 16.2 years of follow-up in an active surveillance scheme."

In contrast to AS, which Shaha and Tuttle [19] have considered to be a policy of "deferred intervention" and others (10) as "an approach for deferral of surgical intervention to a more convenient time," we at Mayo view EA as a definitive treatment in the management of the most common endocrine malignancy, PTC, and an acceptable alternative therapeutic approach to surgery, whether for the elimination of locoregional recurrences [29] or, as in this study, the permanent reduction of tumor mass in PTM. At Mayo, the present charges to patients undergoing EA for PTM are identical to those that our institution, both in Minnesota [26, 27, 29] and Florida [28], has charged for EA in managing NNMs [29, 31]. In 2013, when we compared [27] the charges of immediate surgical intervention (nodal dissection) vs EA for NNM in 25 patients with advanced localized PTC, "each outpatient EA procedure saved health providers approximately $38 400. Our 25 ablated patients, by avoiding 40 further neck re-explorations, on average saved $61 440 in charges." We concluded [27] in 2013 that EA was "considerably less expensive than the conventional operative alternative." In 2020 we are in no doubt that this conclusion would also apply to any future cost comparison of EA vs immediate surgery (unilateral or bilateral lobar resection) in PTM patients. Additionally, as described in the details of our post-EA follow-up schedule, we have followed our ablated patients with sonography primarily to establish stability of tumor mass reduction and secondarily to diagnose either a new PTM focus or a NNM, just as we would in the setting of a patient having a lobectomy. We would not, however, consider this policy to be "active surveillance" [10, 15].

In contrast to potentially following these PTM patients, like our Japanese colleagues [15, 16, 35] for up to 20 years with serial neck sonography every 6 to 12 months [10, 36] at tertiary medical centers, it is our expectation that, as our patients have now been followed for on average more than 5 years without tumor regrowth or recurrence, we are encouraging them to undergo less sophisticated and, likely less expensive, follow-up closer to home with their own endocrinologists. Indeed, already 6 (43%) of 14 surviving patients (cases 2-15), at an average of 6 years post-EA, are being followed not at Mayo but by their local community physicians. A striking example of this fairly prompt transition to the community occurred with case 12, a 41-year-old man who was surgically treated for his stage IIIB melanoma in 2013, had a PTM discovered by PET-CT in 2015, and was treated for his biopsy-proven disease with 0.6 cc of ethanol. His 42-mm^3 tumor disappeared on US and PET-CT by 4 months. Arranged by his oncologists, he had 4 more negative PET-CT scans through 2018, at which point he had "reached the 5-year mark" for his potentially life-threatening malignant melanoma and was dismissed from Mayo care to his primary care physician and his dermatologist. Perhaps a cost-saving lesson could be learned here by thyroidologists, as one must question whether a PTM undergoing AS may require up to 20 years of periodic sonography [10, 15, 36] whereas a metastatic melanoma can be dismissed to the community after only 5 years of specialist care.

In the hands of our team of very experienced interventional sonographers, EA for managing PTM tumors has proven to be highly effective, enthusiastically accepted by patients, and safe. None of the ablated patients, in contrast to our operated-on patients, experienced permanent postprocedure hoarseness or hypocalcemia. The transient neck discomfort was mild and comparable to what our patients have experienced after US-guided percutaneous EA for NNM [27, 29, 31]. All 17 tumor foci were very significantly reduced in size (tumor diameter and volume) by EA (median shrinkage of 93%) after intratumoral Doppler flow was completely eliminated. Eight tumors (47%) in 7 patients (Fig. 3) disappeared on sonography after a median time of 10 months. Nine avascular tumor foci were still identifiable, and median tumor shrinkage in this group was 82% (see Fig. 1). It appears very likely that the still-identifiable foci with present tumor volumes of less than 10 mm^3 (see Fig. 2) observed in cases 6, 7, and 15 will likely disappear at the time of next follow-up. No ablated patient showed an increase in serum Tg during follow-up averaging 63 months and, to date, in contrast to our contemporaneously operated patients, none have been discovered to have either a new PTM focus in the remaining thyroid or a biopsy-proven novel neck metastasis. Clearly the ablated patients who continue to have a stable avascular, shrunken but still identifiable, subcentimeter mass after ablation will continue to be closely followed. Our sonographers and, in time, the local endocrinologists and their radiologists, may have to look very carefully for the remote possibility of tumor recurrence after, now, an average of 5 postprocedure years.

A risk-stratification system proposed by Brito and colleagues [37] characterized low-risk PTC patients as inappropriate candidates for AS if their tumors showed extracapsular extension or were situated in a subcapsular location adjacent to, or invading, the recurrent laryngeal nerve. These contraindications for AS would probably also apply to US-guided ablative therapies (including this present study) and from Japanese AS studies [34]. This minority has been estimated to represent between 3% and 14% of potentially eligible low-risk PTC patients. Given that during 2010 to 2017 we treated at Mayo 282 adult patients with T1aN0M0 microcancers, our 15 ablated patients represented only 5% of the total. By Brito's criteria [37], a further 81% (228 patients) may well have been eligible for either AS or EA. However, during 2010 to 2017 we were providing immediate surgery to most adults with a new diagnosis of PTM. We had only reported to the ATA our EA results from a pilot study [38] of 3 PTM patients in 2013 and were not yet comfortable with promoting EA as a definitive therapeutic option. However, with the encouraging results of this long-term study, we are now convinced that more adult PTM patients in our practice will in the future be eligible for the minimally invasive outpatient option of EA.

Recently, Roman and colleagues [39] from Memorial Sloan Kettering Cancer Center (MSKCC) have attempted to assess the number of PTM candidates in the United States during 2020 through 2024 who may be "eligible for AS." Using a 14% exclusion of inappropriate candidates, they estimated that the total number of PTM patients, who would be "potential candidates for AS" in the next 5 years, would be between 50578 and 61925. In the discussion of these findings, they concluded [39] that "there will be a pressing need for further development of high-quality data on treatment options (including active surveillance and local ablative therapies)…geared specifically for this challenge." We are encouraged by our initial experience of EA in managing PTM and are convinced that many North American patients who do not wish surgery and are uncomfortable with AS for this indolent disease are actively seeking a third alternative. We are confident that, with proper selection of patients and the availability of experienced interventional sonographers with superb diagnostic skills, there can and should be a role for EA in coping with the challenge of managing the multitude of PTM patients predicted by our MSKCC colleagues [39] to be diagnosed during the next 5 years in the United States and likely too in many other countries.

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Additional Information

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Data Availability: Data sharing is not applicable to this article because no data sets were generated or analyzed during the present study.

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