

Percutaneous Thermal Ablation of Low-Risk Thyroid Carcinomas: Towards a New Paradigm?

Mini review

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Abstract

Thyroid cancer incidence has considerably risen since the nineties owing to the development of high frequency ultrasound, cytological diagnostic accuracy of papillary thyroid carcinomas (PTC) and per operative occult microcarcinomas findings. PTC < 20mm is characterized as T1a (<10mm) and T1b (10-20mm) according to the TNM stage classification and the AJCC staging system. Papillary thyroid microcarcinoma (mPTC T1a) is the most common subtype (85% of thyroid cancers), has an excellent prognosis and a disease-specific survival >99% at 10years follow-up. Most guidelines recommend thyroid lobectomy as the first-line treatment strategy for low-risk unifocal mPTC. However, thyroid surgery has significant costs and morbidity rates (hypothyroidism, recurrent laryngeal nerve dysfunction), resulting in poorer quality of life. To de-escalate the treatment and reduce surgery-related morbidity, percutaneous thermal ablation for low-risk PTC can be proposed to the patient, who nowadays clearly belongs to an integral part of the therapeutic decision-making process.

Keywords

Thermal Ablation, Radiofrequency Ablation, Microwave Ablation, Laser Ablation, Papillary Thyroid Carcinoma, Ultrasound, Thyroid Surgery, Fine Needle Aspiration Cytology, Percutaneous Treatment

Abbreviations

RFA: Radiofrequency Ablation; PTC: Papillary Thyroid Carcinoma; MPTC: Papillary Thyroid Microcarcinoma; FNAC: Fine Needle Aspiration Cytology; AS: Active Surveillance; HFUS: High Frequency Ultrasound; MWA: Microwave Ablation; LA: Laser Ablation

Background

Papillary thyroid carcinoma (PTC) is the most common endocrine malignancy and accounts for the majority of thyroid malignancy.

The dramatic increasing incidence is attributed to the tremendous development of high frequency ultrasound HFUS sensitivity and dedicated semiology [1-3], fine needle aspiration cytology, EuTirads scoring [4], and Bethesda system classification [5], and the incidental detection of small papillary thyroid carcinoma whose greater diameter is less than 10mm, the so-called microcarcinoma (mPTC). Thyroid lobectomy has risen concomitantly, however with no significant decrease in thyroid cancer mortality. This may suggest that surgical management of thyroid carcinoma should henceforth evolve to prevent from overtreating low-risk cancer patients. That means adopting appropriate limited thyroid surgery for low-risk carcinoma, avoiding systematic prophylactic central nodal dissections, assessing lymph node lateral compartment by using HFUS, or proposing other alternatives to the patient. The last decade has shown the emergence of active surveillance (AS) of mPTC as a viable alternative option instead of immediate surgical treatment. Moreover the rise of less aggressive minimally invasive ablative techniques such as thermal ablation has shown very good and promising results [6,7]. A recent meta-analysis has demonstrated complete disappearance of the tumor in almost 80% of cases after RFA, with minimal complication rate [8]. The goal of this minireview is to report the various therapeutic modalities of low risk T1ab papillary thyroid carcinomas.

Results

WHO Classification

The WHO Classification of Endocrine and Neuroendocrine Tumors, fifth edition results, from now on, in a systematic classification based on the cell of origin of tumors and their clinical risk. Genetic mutations in follicular cell-derived thyroid neoplasms highlight the role of mutations in the MAP kinase pathway, including RET, RAS, and BRAF, as drivers of carcinogenesis. Differentiated thyroid malignant tumors include follicular thyroid carcinomas and papillary thyroid



carcinomaS, which have specific genetic alterations that correlate with morphological classifications: RAS-like tumors and BRAF p.V600E-like tumors [9]. Papillary thyroid carcinoma is the most common subtype of thyroid malignant neoplasm, accounting for approximately 85% of thyroid cancers [10]. PTC measuring 10 mm or less, the so-called papillary thyroid microcarcinomas, account for an increasing proportion of thyroid cancers; Patients presenting mPTC have a disease-specific survival of more than 99% after 10 years of follow-up.

Role of High Frequency Ultrasound (HFUS) of the Neck

The most important gross characteristics of PTC include single or multiple nodules, location of the suspicious nodules, presence of invasive growth of the thyroid capsule [11] and of the internal jugular vein [12]. HFUS plays a determinant role in the diagnosis, size location of the tumor and lymphadenopathy in the central and lateral compartments of the neck [13]. Notably, BRAF p.V600E exhibits high specificity for PTC diagnosis. Detection within FNAC specimens plays a pivotal role in diagnosing a suspicious thyroid nodule [14,15]. US-guided thyroglobulin wash out [16] has a high sensitivity to diagnose suspicious lymph node located in the central or lateral compartment of the neck [17]. All these items should be recorded on a final scheme before a multidisciplinary council. Patients presenting with high-risk variants including the following aggressive types, ie: diffuse sclerosing variant, tall cell variant, columnar cell variant, solid variant, hobnail variant, should undergo thyroid surgery [18].

Thyroid Surgery

Most guidelines concerning thyroid cancer care now recommend a thyroid lobectomy as the first-line treatment strategy for low-risk unifocal mPTC. Conformal thyroidectomy has an event-free survival that is not inferior to that of lobectomy, shows advantages in perioperative management and short-term complication rates over lobectomy [19]. However, thyroid surgery comprises significant costs and morbidity rates caused by iatrogenic hypothyroidism and recurrent laryngeal nerve damage, resulting in patient's poorer quality of life. To de-escalate the treatment of mPTC and reduce surgery-related morbidity, less-aggressive treatment strategies such as active surveillance [20] and thermal ablation [21,22] have been proposed to low-risk mPTC patients.

mPTC patients presenting with clinical lymph node metastasis, distant metastasis, recurrent laryngeal nerve paralysis due to carcinoma invasion, or protrusion into the tracheal lumen warrant immediate surgery. Moreover, tumors suspected of aggressive subtypes on FNAC / HFUS [18] are recommended for immediate surgery. Immediate surgery is also recommended for tumors adherent to the trachea or located along the course of the RLN, young patients <20years old, patients with previous radiation therapy of the neck, familial history of thyroid neoplasm [18,23].

Active Surveillance

Worldwide observational studies have confirmed that favorable outcome of mPTC during AS is related to the indolent course of the disease and not to the efficacy of active treatment. Active surveillance proposed by Sugitani et al [20,24]. is a watchful waiting policy allowing the practitioner to closely monitor mPTC patient's condition without treatment until focal thyroid disease is in progression at HFUS assessment follow-up. AS appears to reduce overtreatment in patients with low-risk mPTC without compromising cancer-specific survival at 10 years. Therefore, AS is an option for selected mPTC patients who refuse thyroid surgery or are contraindicated to, or who want to avoid the side-effects related to thyroid surgery. However, inclusion criteria for AS have not yet been standardized. The assessment of growth rate could help to distinguishing mPTC with high growth rate from low growth rate, and tailor the appropriate schedule for a personalized patient's care [25].

Thermal Ablation

Thermal ablation primarily includes three main percutaneous techniques: laser ablation, radiofrequency ablation and microwave ablation. Radiofrequency ablation is a nonsurgical, minimally invasive technique that relies on alternating electromagnetic current to cause molecular frictional heating to control tissue nodule [22,26,27]. Although RFA is currently used mostly in patients with benign compressive or hot nodules, in recurrent PTC patients or in patients contraindicated for surgery, recent evidence states that RFA could be an efficient treatment for low-risk mPTC patients and has been shown to be probably more effective and used than microwave ablation or laser ablation [28]. RFA showed the highest mean volume reduction rate (99.3%), followed by MWA (95.3%) and LA (88.6%). Ideal candidates for RFA thus may include low-risk solitary (us) T1a N0mPTC patients and even (us) T1bN0 PTC patients [28] who are at high surgical risk, have short life expectancy, relevant comorbidities, or are unwilling to undergo surgery or AS [21]. A recent meta-analysis [8] demonstrated seductive results, showing complete disappearance of the thyroid tumor in almost 80% of cases among fifteen studies comprising 1770 patients, 1822 thyroid tumors during a mean follow-up time period of 33 months (range, 6-131months) after RFA. Interestingly the overall tumor progression rate was reported as low as 1.5%. The complication rate was 2.5% including transient dysphonia and temporary cardiac arrhythmia.

Moreover, RFA could also be proposed as an alternative to surgical neck dissection in patients with radioiodine refractory neck recurrences, who are contraindicated for surgery or who decline further surgery. Factors that favor RFA include previous neck dissection, previous surgical complications, small size metastases, and less than four cervical metastatic lymph nodes of the lateral compartment of the neck.

Future Directions

Percutaneous thermal ablation of low risk- PTC should be performed under local anesthesia, as coughing or patient's voice's modifications are major clinical warning signs for the operator, thus of major help to preventing major complications [29]. Thus, using patient-relaxing "let it go" therapies [30-32] may initiate the way to patient's well-being awareness. Monpeyssen et al recently put the stress on the present phase of transition from traditional academic decision making towards the patient-centric healthcare choice for percutaneous RFA of PTC [33]. Times are changing, treatment option strategy thus requires permanent technical innovation, a secure rapid effective and individualized patient's care and quality of life assessment [34].

Conclusion

The novel era of clinical decision making regarding low-risk PTC patients may lead to an individualized patient's care, local tumor destruction with organ function preservation, improvement of per procedural welfare and quality of life. Percutaneous RFA procedure is safe, effective, rapidly performed on an outpatient basis, ideally by using local anesthesia and sophrohypnosis "let it go" technique with no or limited analgesia.

Conflicts of Interest

"The authors declare that they have no conflicts of interest."

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