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Image Guided Ablations for Thyroid Tumours

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Abstract

Image guided ablations might be regarded as a promising effective and safe alternative for treatment of recurrent thyroid cancer in particular in patients with high surgical risk or refusing surgery. Furthermore, image guided ablations seems to represent a promising alternative to surgery or observation for micropapillary thyroid carcinoma, with the aim of providing an effective treatment with minimal invasiveness. Further studies are necessary to confirm the role in this setting

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Introduction

Thyroid nodules are a very frequent condition in general population, with a prevalence ranging between 20% and 76% [1]. The large majority of these nodules are benign and casually discovered. Thyroid cancer instead is relative infrequent, representing around 1–5% of all cancers in females and less than 2% in males [2]. Benign thyroid nodules generally do not require medical or surgical treatments, unless they can cause symptoms, like discomfort, dyspnea, hoarseness or cosmetic concerns [3, 4], or if they produce active hormone [5]. Until now, the standard treatment of benign nodules of thyroid is still represented by thyroidectomy (total or partial) [4, 6] which, however, remain a major surgical procedure, with correlated morbidity and potential complications ranging between 2.5% and 8.1% [7].

In order to reduce the invasiveness of treatment, in the past years image guided ablations have been successfully applied in the treatment of benign thyroid nodules to obtain a meaningful reduction in nodule's size and consequent improvement of related symptoms [8–13]. Image guided ablations have been reported to provide excellent results in benign nodules with minimal invasiveness, so that has been proposed as a potential first choice option for the treatment of benign thyroid nodules [14].

More recently, image guided ablations have also been applied in the treatment of thyroid malignancies, both for primary cancer and for recurrent or metastatic disease [15–21]. The role of image guided ablations in this setting is still limited and debated, but could be an interesting additional treatment in the multidisciplinary approach to thyroid cancer patients. The two most widely used techniques in the treatment of benign and malignant thyroid disease are radiofrequency ablation (RFA) and laser ablation (LA) [22-24], while microwave ablation (MWA) is emerging as a promising technique.

RFA still represent one of the most widely used ablative technique in the interventional field, being applied for the treatment of several kind of tumors in different organs [25-28]. RFA has been successfully applied in the treatment of recurrent thyroid cancers in patients considered at high surgical risk or refusing surgery. In this setting RFA has been reported to have an elevated technical success, with a significant reduction in serum thyroglobulin, as reported by a recent systematic-review and meta-analysis [29]. In the treatment of small recurrences (< 2 cm) Kim et al [30] reported a similar 1- and 3- year recurrence free survival when comparing RFA (96.0% and 92.6%, respectively) and surgical reoperation (92.2% and 92.2%, respectively). Recently, the detection of small indolent papillary thyroid carcinoma has increased, without a consequent increase in thyroid cancer mortality, highlighting how those tumors might only have been overdiagnosed. Thus, some authors even proposed not to treat small micropapillary thyroid tumors, which have a very low risk, but only to follow them up, in order to avoid the invasiveness of a surgical treatment and to spare the thyroid function. A different approach would be to minimize the invasiveness of the treatment, thus providing a cure for the patient, but avoiding the drawbacks of surgery. In this scenario image-guided ablations seems to offer a promising therapeutic alternative. Thus, some ablative techniques, such as RFA, has also been applied in the treatment of papillary thyroid microcarcinomas [31]. Zhang and colleagues reported on the application of RFA in 92 patients with micropapillary thyroid carcinomas, and found a significant volumetric reduction of the treated nodules over time, with no residual tumor at core-needle biopsy nor recurrences during follow-up [31]. Also, no major complications occurred in their series.

Laser ablation uses the smallest applicators among various ablative techniques and represent a very interesting ablative method particularly in reason of its low invasiveness and high precision, which can provide some advantages in a highly complex anatomical region such the neck [32-35]. Laser ablation has also been one of the first techniques used for thyroid thermal ablation, and its use has been reported in the treatment of benign, hyperfunctioning, and malignant thyroid diseases [34, 36-40]. Furthermore, safety of laser ablation has been described in several studies, with a low number of major complications. In a multicenter study performed by Pacella et al [41] on 1,837 treatments, an overall complication rate of 0.9% was reported. Our group applied laser ablation in the treatment of patients with metastatic nodes from papillary thyroid carcinoma, with promising results and a limited number of minor complications [34,42].

In 2011 Papini [18] performed laser ablation on incidental papillary thyroid microcarcinoma diagnosed in a patient unsuitable for surgery; during follow-up by ultrasound-guided fine-needle aspiration biopsy and core-needle biopsy performed 12 months after treatment no neoplastic cells were discovered. Valcavi et al. [19] reported a series of three patients with a single papillary thyroid microcarcinomas: in all cases, there was no evidence of residual neoplastic tissue. Zhang et al reported 64 patients with papillary thyroid microcarcinoma treated with laser ablation, with a mean largest diameter reduction from 4.6 ± 1.5 to 0.6 ± 1.3 mm ($p < 0.0.5$), and the average volume reduction from 41.0 ± 40.4 mm^3 to 1.8 ± 6.7 mm^3 ($p < 0.0.5$). They also highlighted the potential role of contrast-enhanced ultrasound in the assessment of completeness of treatment, as two patients required treatment completion after CEUS was performed [43-44]. So, despite the actual evidences are limited, image-guided ablations seems to be a promising treatment strategy for small papillary thyroid cancers, holding the potential of compensating for image-guided deriving overdiagnosis [45].

In conclusion, image guided ablations might be regarded as a promising effective and safe alternative for treatment of recurrent thyroid cancer in particular in patients with high surgical risk or refusing surgery. Furthermore, image guided ablations seems to represent a promising alternative to surgery or observation for micropapillary thyroid carcinoma, with the aim of providing an effective treatment with minimal invasiveness. Further studies are necessary to confirm the role in this setting.

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