



Radiofrequency ablation of thyroid nodules: a narrative review and perspective on the patient experience and quality of life

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Background and Objective: Thyroid ablation techniques have emerged as minimally invasive therapeutic tools to treat benign and malignant disease. Radiofrequency ablation (RFA), in particular, has seen rapid adoption, and its safety and efficacy for the appropriate candidate is supported by a growing body of literature. As alternative strategies for treating thyroid disease emerge, a more tailored approach to management is required. A central component of this decision-making process is understanding the impact of treatment on quality of life (QOL) and patient satisfaction.

Methods: A literature search was conducted in PubMed and Google Scholar to identify articles in English published between 1990 and March 2022 addressing QOL outcomes or patient satisfaction following RFA for benign or malignant thyroid disease. All study designs were included.

Key Content and Findings: Though limited studies suggest superior outcomes in certain QOL or satisfaction metrics following RFA, there is demonstrated need for greater evidence in this domain. The development of a validated survey instrument specific to RFA is particularly important to more accurately assess the treatment impact and true utility of this technology. Such results are necessary to incorporate in decisions regarding procedural candidacy and to frame discussions with patients regarding priorities and expectations.

Conclusions: This review provides a summary of evidence to date regarding QOL outcomes in patients who have undergone RFA for benign nodules as well as for papillary thyroid microcarcinoma. It additionally highlights opportunity for high quality and specific assessment of QOL implications, particularly in comparison with conventional approaches.

Keywords: Radiofrequency ablation (RFA); thyroid ablation; thermal ablation; quality of life (QOL); patient satisfaction

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Introduction

Radiofrequency ablation (RFA) has been the subject of growing international enthusiasm in the realm of thyroidology. Based on the generation of frictional heat,

it is a thermal ablative technique shown to be an effective, minimally invasive alternative to surgery for patients with symptomatic goiter and low-risk malignancy (1,2). In the United States currently, RFA is primarily performed for

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Table 1 The search strategy summary

Terms	Specification
Date of search	April 2022
Databases and other sources searched	PubMed, Google Scholar
Search terms used	Radiofrequency ablation, thermal ablation, thyroid ablation, benign thyroid nodule, papillary microcarcinoma, quality of life, patient satisfaction
Timeframe	1990–2022
Inclusion criteria	English language
Selection process	Both authors independently screened; relevant data extraction by joint review and consensus

benign nodules. Intervention for benign thyroid disease is recommended when compressive symptoms are present, including dysphagia, dysphonia, neck fullness/pressure, or dyspnea. Numerous guidelines to date have indicated that RFA may be offered to patients with a sizeable thyroid nodule that is clearly contributing to such symptoms, and/or is causing visible cosmetic disturbance (3–6). As such, patient reported outcomes and satisfaction with such a procedure are paramount to determining its success and role relative to existing therapies.

More recently, applications for RFA have expanded to include low-risk malignancy, specifically, papillary thyroid microcarcinoma (PTMC) (7–10). Traditionally, PTMC could be treated surgically or observed with serial ultrasound as part of an active surveillance protocol. With the introduction of RFA as a minimally invasive therapeutic option, current discussion centers around patient selection and the optimal use of this technology in the context of established approaches. Because of the indolent growth of PTMC, impact of any treatment on long term quality of life (QOL) is a primary factor in personalizing the approach to care.

Though clinical outcomes in RFA are increasingly well described, as with any new technology, additional work is required to understand how best to use these methods to optimize care. The potential applications of the procedure require greater scrutiny in assessing and quantifying the impacts on patient QOL and treatment experience to guide use and understand impact relative to established therapies. The following review summarizes the available literature to date addressing QOL and patient satisfaction in RFA for thyroid disease, and identifies direction for future investigation. We present the following article in accordance with the Narrative Review reporting

checklist (available at <https://aot.amegroups.com/article/view/10.21037/aot-22-12/rc>).

Methods

A literature search was conducted in PubMed and Google Scholar in April 2022, with a secondary search of the references of each included publication. Search terms were as follows: radiofrequency ablation, thermal ablation, thyroid ablation, benign thyroid nodule, papillary microcarcinoma, quality of life, patient satisfaction. Included articles were published in the English language between 1990 and March 2022. All study designs were included. The selection process was conducted by both authors independently. This process is represented in *Table 1*.

Comparison of current treatments: surgery vs. RFA

Surgery has long been the cornerstone of treatment for benign nodules that have become symptomatic or continue to grow during follow-up. While its efficacy in removing the causative nodule is indisputable, the risk of complications, both temporary and permanent, remain a primary concern and reason for patient avoidance. Equally important is the potential for thyroid hormone dependence, subtle physical or metabolic changes, and the assurance of a scar, all of which impact a patient's QOL and perception of well-being (11).

An initial retrospective study by Yue *et al.* administered the SF-36 to determine impact on QOL in 137 patients undergoing RFA and 267 receiving open hemithyroidectomy (12). At 6 months post-treatment, the RFA group reported significantly better scores in general health, mental health, and vitality

than the surgery group. In propensity matching, patients who underwent hemithyroidectomy reported lower scores than the general population in all three of these domains (12). Another retrospective comparison recruited 126 patients treated with RFA and 84 with surgery and conducted post-operative phone surveys to assess treatment satisfaction (13). While there was no difference in overall satisfaction between the two groups, significantly more patients in the RFA group were pleased with the cosmetic outcome. In regard to symptomatology, RFA and surgery were equally effective for patients with nonfunctioning nodules, but patients with functional nodules were more satisfied with symptom resolution following surgery than RFA (13).

A prospective randomized clinical trial of 450 patients comparing open thyroid surgery to thermal ablation (RFA or microwave ablation) comprehensively assessed patient satisfaction via multiple tools, including a thyroid specific QOL questionnaire, a health-related QOL questionnaire, and a patient satisfaction score on a Likert scale (14). In regard to thyroid specific symptoms at 15 months, fewer patients in the conventional thyroidectomy group reported continued dysphagia, tracheal compression, and peculiar sensation in the throat relative to the thermal ablation group. Concerning general health, the thermal ablation group reported higher scores for total social and total psychological well-being, while the open surgery group reported better scores in the physical well-being domain. Patients undergoing ablation experienced less peri-procedural pain and were able to return to work, social, and athletic activities significantly earlier than the surgery group. Finally, 94% of patients who received ablation would recommend the treatment to a friend *vs.* 32% of those who underwent thyroid surgery (14).

As suggested by the above studies, there may be specific QOL domains in which ablation outperforms surgery, and others in which surgical removal may yield greater results. Additional work specifically addressing patient satisfaction and QOL is important to clarify the differential impact of RFA and surgery to optimize satisfaction and facilitate individualized therapy.

QOL after RFA for benign disease

While the safety and efficacy of RFA for benign thyroid nodules have been extensively described, more comprehensive metrics regarding QOL and well-being are less well established. An early study by Valcavi *et al.* administered the SF-12, an abridged version of the validated health-related QOL survey SF-36, to patients undergoing

RFA for benign nodules (15). Both physical and mental domains improved significantly from pre-treatment to 12 months post-treatment, as did the visual analog cosmetic score. All values remained stable between 12 months and 2 years of follow-up (15). Subsequent study in the UK also reported significant improvement in thyroid related QOL among 23 patients with both cold and functional nodules, as determined by the abbreviated patient reported outcome survey ThyPRO (16). Retrospective study in the Korean population matched 289 pairs of patients receiving RFA or microwave ablation and administered a 4 domain QOL questionnaire constructed by the Korean Thyroid Association up to 18 months post-procedure (17). In the RFA group, the average total score at 18 months post-procedure was 373 out of a total possible of 410, an improvement from the preoperative average of 258. Furthermore, 204 patients (71%) reporting scores >400 (17). A prospective multi-center study similarly reported increased QOL in all physical and psychological domains of a thyroid specific QOL questionnaire completed by 55 patients up to 12 months post-RFA (18). Subanalysis showed that symptoms more directly related to nodule size (i.e., anxiety and cosmetic concern) improved to a greater extent than less clearly correlated symptoms like fatigue, cognition, and depression (18).

Conversely, Oddo *et al.* found no change in the individual ThyPRO domains 36 months following RFA, though the overall subjective impact of thyroid disease on QOL did improve (19). This may, in part, be attributable to a modest average volume reduction of 45%, though additional stratification by reduction >30% and reduction <30% did not yield differences between the two groups (19).

Overall, precise understanding of the QOL implications of RFA in benign disease are challenging, in part due to the significant heterogeneity in data. Studies discussed above have employed validated questionnaires, study or institution-specific surveys, Likert scales, or likelihood-to-recommend scores, precluding the aggregation of measures into systematic review. Furthermore, many studies are retrospective in nature, and lack long term follow-up beyond 12–18 months. Additionally, as volume reduction is typically the key outcome in RFA for benign thyroid nodules, studies are not necessarily powered to detect differences in QOL between groups or from the pre- to postoperative state. Only one multi-institutional, prospective and randomized trial has been conducted (14), and, while perhaps challenging in some settings and populations, points to the feasibility and necessity of high quality study design in contributing meaningful analysis to

this discussion.

QOL after RFA for malignancy

In recent years, there has been increasing attention on the role of RFA in the treatment of low-risk thyroid malignancy, particularly PTMC. Many studies have demonstrated excellent volume reduction and high rates of complete disappearance after single session of RFA for PTMC (7,9,10). As a result, RFA is emerging as an appealing therapeutic alternative for a disease typically managed with surgery or active surveillance. QOL assessment in thyroid cancer is nuanced, and influenced not only by concern over diagnosis and fear of recurrence, but also by anxiety regarding management decisions (20,21). Because patients with PTMC have generally excellent prognoses regardless of treatment approach, QOL and patient satisfaction become even more important metrics to optimize well-being in this population.

Studies to date evaluating QOL in PTMC management compare RFA with conventional surgery. In long term follow-up of 174 patients followed for 5 years, surgical patients reported worse overall QOL compared with those receiving RFA as assessed by the THYCA-QOL questionnaire (22). Specifically, domains affected included voice, sympathetic symptoms, throat/mouth concerns, psychological problems, sensory problems, issues with the scar, temperature sensitivity, and weight gain (22). Another retrospective comparative study used three surveys, including the SF-36, THYCA-QOL, and Fear of Progression Short Form (FOP-Q-SF) to evaluate QOL following RFA or open thyroid surgery in 88 patients with 5 to 20 months of follow-up (23). On the SF-36 general health assessment, the RFA group reported significant improvement over the surgery group in several domains, including role-physical, bodily pain, social functioning, and role-emotional, also contributing to a higher total physical component score. On the THYCA-QOL questionnaire, problems with the scar were identified more frequently by surgical patients, while the FOP-Q-SF did not yield any difference between the two groups in any domain (23). Specific factors negatively affecting QOL among PTMC survivors following RFA include female sex, neuromuscular and throat/mouth symptoms, anxiety, and fear of physical health (24).

As therapy for small and indolent thyroid cancers becomes increasingly individualized, RFA offers an alternative approach that minimizes risk while maintaining

oncologic outcomes comparable to surgery (22,25,26). Though our understanding of the expected treatment result from RFA in PTMC is growing, there is limited, predominantly retrospective and single-institution data addressing QOL. Thus far, QOL assessment in malignancy has focused on surgery, but has yet to incorporate analysis of the impact of RFA relative to active surveillance. There remains significant opportunity to examine such metrics regarding conventional, minimally invasive, and surveillance approaches for patients with PTMC.

Limitations of current QOL instruments

A primary limitation of QOL analysis in RFA is the use of varied QOL assessment tools that lack procedural or disease-state specificity. The prognosis of conditions treated by RFA, both benign and malignant, is generally favorable. When the impact of the disease process on global QOL is less significant, general instruments may fail to completely capture nuanced outcomes and changes, as participants tend to score highly on initial surveys. This “ceiling effect” limits the content validity, reliability, and responsiveness to a change of the instruments (27). Illustrating this point, a comparative study of QOL assessment tools for PTMC patients evaluated responses from patients with PTMC undergoing RFA and surgery (23). Participants in both groups scored, on average, >80 points on the SF-36 (higher scores indicate better QOL), and less than 20 and 3 points, respectively, on the THYCA-QOL and FOP-Q-SF (lower scores indicate better QOL) (23). The high baseline QOL scores render the detection of subtle differences between treatment approaches challenging, and may lead to inaccurate assumption of equivalent impact.

This is not surprising given the methods of development and the intention behind the creation of these instruments. The THYCA-QOL was developed using thyroid cancer survivors of all stages and prognoses, which may not accurately reflect the considerations of those with low-risk thyroid cancer or benign disease (28). Similarly, the Fear of Progression Questionnaire was developed in breast and colon cancer patients, as well as those with diabetes and rheumatic disease, all of which have very different courses and considerations compared with thyroid disease (29). The use of these evaluations, therefore, may provide an incomplete picture of the benefits and motivations of patients pursuing RFA over other treatment alternatives.

The ThyPRO is another commonly utilized QOL tool in thyroid disease. In its complete and original form, it is an

84-item questionnaire that was developed and validated on all thyroid patients at two university hospitals in Denmark (30). A validated short form 39 item survey is also available (31). The questionnaire includes questions which focus on goiter symptoms, hyper and hypothyroid symptoms as well as eye symptoms, cognitive complaints, anxiety, depressivity, cosmetic concerns, and coping abilities. The questionnaire was developed and validated using both hormonally imbalanced and euthyroid patients (20% had graves, 22% had autoimmune hypothyroidism, 32% on levothyroxine and 18% on antithyroid medication) (32). While this tool has been fundamental in assessing the impact of various treatments on benign thyroid conditions, it may not entirely capture the concerns of the RFA population, particularly as the majority do not present with hormonal imbalance.

Toward a new assessment tool

The decision-making process in thyroid disease is complex, and the availability of RFA introduces additional nuance into the treatment discussion. The priorities and expectations of a patient pursuing RFA are fundamentally different than those of a patient choosing surgery or observation, and are also likely distinct in benign and malignant conditions. For this reason, there is opportunity and need for the creation of a more tailored instrument assessing QOL and satisfaction in this group. Patient interviews and focus groups are required to understand the attitudes, opinions, behaviors, and motivations of patients undergoing RFA. Specifically, it is important to define which factors, both individual and disease specific, contribute to the initial treatment decision. Post treatment evaluation must then accurately and completely measure the physical, mental, and psychosocial impact of and response to treatment with RFA. While validated instruments to assess thyroid specific QOL are available and have been employed to date in the literature (18,24,28,30), this patient group is unique and driven by a distinct set of opinions and perceptions. Development of an instrument evaluating these factors specific to RFA is necessary to facilitate patient counseling, individualized therapy, and a more comprehensive understanding of the true utility of this technology.

Conclusions

RFA is increasingly offered as a minimally invasive alternative to surgery or observation for both benign and malignant thyroid conditions. A growing body of literature

supports its efficacy and safety, and guideline statements ensuring the responsible application of this technology are available. However, in order to most effectively aid in eligibility decisions, shared decision making, and determination of outcomes, the QOL assessment used must be rigorous and specific enough to capture the distinct needs of this population.

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