

<https://doi.org/10.54500/2790-1203-2023-2-116-18-21>

IRSTI 76.29.49

UDC 616.44-006.6-089

Review article

THE ROLE OF MICROWAVE ABLATION IN THE TREATMENT OF PAPILLARY THYROID CANCER: A SYSTEMATIC REVIEW

Aili Saiding

Chief physician of the Guangyuan Central Hospital, Guangyuan, Sichuan, China. CVG4+WQQ, Juguo R d, LiZhou Qu, Guang yuan Shi Chuan Sheng, China, 628032. E-mail: 1443197741@qq.com

Abstract

Thyroid papillary carcinoma (PTC) is the most common type of thyroid cancer (TC). In recent years, the incidence of PTC in human has gradually increased. Thyroidectomy was the first-line treatment for PTC recommended by several guidelines, but some views was proposed that microwave ablation (MWA) can as an alternative treatment for PTC ≤ 10 mm in size, there are still some controversies regarding the efficiency and safety of MWA. Therefore, this systematic review aimed to conclude the current treatment status and research progress of MWA in the treatment of PTC.

Based on relevant domestic and international guidelines and the latest clinical research, the development status and prospects of MWA were discussed.

Conclusions: MWA has the advantages of treatment for solitary T1N0M0 papillary thyroid carcinoma, However, PTC (size >10 mm) and multifocal PTC (size ≤ 10 mm) remains controversial with MWA surgery.

Keywords: Thyroid, Papillary carcinoma; Surgery; Microwave ablation; systematic review.

Material received: 18.03.2023

Material accepted for publication: 04.04.2023

Reference for citation: Aili Saiding. The role of microwave ablation in the treatment of papillary thyroid cancer: A systematic review. Astana Medical Journal. 2023; 2(116): 18-21. <https://doi.org/10.54500/2790-1203-2023-2-116-18-21>

Background

Thyroid cancer is one of the most common endocrine tumors. Compare man, it is more common in women, with a 3:1 female-to-male ratio in total, during the last decades, the incidence of thyroid cancer has increased 7.1‰ to 17.6‰ from 2000 to 2013, especially PTC [1]. Although we also need to consider the impact of advances in diagnosis and treatment methods and social conditions on the incidence of thyroid cancer, and PTC is the main reason of the increase in TC incidence. There has been a substantial debate about which the increase in PTC represents increase in the incidence of TC [2, 3] but this is not the key point of our review.

In the past, thyroidectomy always has been considered as the first line treatment for PTC. However, patients need to take medicine for lifelong after surgery, and surgery leave scars on the neck, which has a impact of their Physical and psychological. Nowadays, thyroid nodules thermal ablation (TA) is being popular due to safe, short surgical time, and fast postoperative recovery. TA gradually becomes another treatment method for thyroid nodules [2]. Currently, TA in clinical practice including radiofrequency ablation (RFA), microwave ablation (MWA) and laser ablation (LA). TA can temporarily increasing the temperature in the target tissue (50°C~80 °C) to cause coagulative necrosis of thyroid nodules,

and the coagulated necrotic histiocyte will eventually be absorbed by lymphocytes and blood vessels in the body [4].

In recent years, the thermal ablation guidelines of thyroid cancer have been successively announced in Europe [5], the American [6], South Korea [7], and China [8]. TA has gradually been applied to thyroid cancer, but thyroid cancer ablation has strict surgical indications, such as whether it is multifocal, the tumor has invasion and lymph node metastasis. Some studies have proposed that PTMC and status factors is completely suitable for thyroid MWA [9-11]. However, the clinical application of this technology is still in a stagnant state, because the lack of large-scale postoperative follow-up and authoritative evidence-based medical evidence.

This review summarized the latest progress in thyroid cancer TA from the aspects of pathogenesis of thyroid cancer, indications, contraindications, prognosis, and complications. In addition, we intended to help surgeons with a better understanding of the latest mainstream viewpoints, and to provide some reference for standardized treatment of thyroid cancer with TA.

Pathogenesis of Thyroid Cancer

Differentiated thyroid cancer. Differentiated thyroid cancer accounts for over 95% of thyroid cancer [12], originating from thyroid follicular epithelial cells. And it includes PTC, follicular thyroid cancer, and Hurthle cell thyroid cancer. PTC is the most common subtype among differentiated types [7], it has a good prognosis and less metastasis. Compared to papillary cancer, follicular thyroid cancer, Hurthle cell thyroid cancer, and poorly differentiated thyroid cancer have a poorer prognosis and metastasis with the lungs.

Anaplastic thyroid cancer. The incidence of anaplastic thyroid cancer is very low, about less than 1% [12]. Patients early may appear neck lumps, throat discomfort, hoarseness, and even difficulty swallowing [13, 14], even are accompanied by metastasis. The

Indications and contraindications for MWA in the treatment of PTC

Among TA ablation methods, the area of LA ablation is precise, however, during the surgical process, the tissue around the laser fibers is easy to carbonization, resulting in poor light penetration and ultimately affecting the surgical effect [20]. RFA has a relatively smaller impact on surrounding tissues, but due to the cooling effect of the surrounding blood flow, its effect on nodules around the blood vessels is not satisfactory [21]. MWA has the characteristics of high efficiency, less impact on surrounding tissues, and long surgical duration, which is now widely used in clinical practice [22].

Due to the lack of long-term follow-up studies on large sample sizes after thyroid cancer thermal ablation, there is no unified standard for this controversy worldwide. The population situation in each region's research is also different, therefore, corresponding diagnostic and treatment standards was established. In 2015, the American Thyroid Association (ATA) published a guideline named "2015 American Thyroid Association Guidelines for the Diagnosis and Treatment of Adult Thyroid Nodules and Differentiated Thyroid Cancer", this guideline deems PTMC is less invasive and has a good prognosis [23]. So for low-risk PTMC patients, active follow-up should be considered instead of immediate surgery. But most patients are more willing to accept relatively active intervention measures early, such as surgery, rather than just active follow-up. Currently, various regional guidelines consider surgery as the preferred treatment, while the European 2021 guidelines suggest that for some PTMC patients who refuse surgery or cannot undergo an operation, and MWA can also be considered [5]. Joint consensus among multiple countries

Prognosis and complications for MWA in the treatment of PTC

According to current research, MWA is very effective and safe in treating low-risk PTMC. Although MWA has some limitations in the treatment of PTMC indications, relevant studies still believe that MWA can cure PTMC and reduce patients' mental stress burden. Many retrospective and meta-analysis studies have shown that MWA and surgery have no significant difference in the incidence of postoperative local recurrence, distant metastasis, and the incidence of secondary surgery in the treatment of PTMC, and hypothyroidism rarely occurs after MWA. A multicenter retrospective study initiated by Cao et al. [24], 725 PTMC patients confirmed by biopsy received MWA or RFA treatment. After ablation, the maximum tumor diameter and volume at 6, 12, 18, 24, 36, and 48 months of follow-up were significantly reduced compared

to before ablation. 515 patients (71.0%) showed complete disappearance of PTMC on ultrasound examination, 19 patients (2.6%) experienced complications during the follow-up period after ablation.

to before ablation. 515 patients (71.0%) showed complete disappearance of PTMC on ultrasound examination, 19 patients (2.6%) experienced complications during the follow-up period after ablation.

Medullary thyroid cancer. Medullary thyroid cancer is rare, accounting for approximately 1-2% of thyroid cancer [17, 18]. Patients may have unilateral or bilateral thyroid masses, dyspnea, dysphagia, hoarseness, hand and foot twitching, carcinoid syndrome, etc. Because the disease often occurs cervical lymph node metastasis, 70% of patients can find cervical lymph node metastasis during surgery [19]. The prognosis of this type of tumor is poor.

and regions recommended TA is increasingly applied as a safe, minimally invasive [6]. Overall, various regions guidelines around the world are as follows: solitary lesion PTMC limited to the thyroid gland, with no evidence of extrathyroid or capsule invasion, cytological confirmation of non-invasive subtypes, no evidence of metastatic lymph nodes, patients refuse surgery or do not tolerate surgery. The indications for the treatment of recurrent thyroid cancer using thyroid TA guidelines are as follows: patients with recurrent papillary thyroid cancer who are not suitable for surgery or refuse surgery, actively follow-up.

The contraindications for thyroid microwave ablation proposed by Europe in 2021 include: cytological suspicion of invasive subtypes of thyroid cancer (such as high cells, island cells, and columnar cells), Imaging of extrathyroid invasion or multiple tumor lesions, existence of lymph nodes or distant metastasis, high risk gene mutation detection (such as TERT promoter and TP53 mutation). China published the thyroid MWA contraindications in 2019 are as follows: discovery of cervical lymph nodes during initial diagnosis transfer or distant transfer, severe bleeding prone coagulation disorder or taking anticoagulant drugs, severe heart and lung diseases, liver and kidney failure, Inability to tolerate neck extension disorders due to consciousness disorders, there are coarse calcifications in thyroid microcarcinoma, puncture biopsy shows the coexistence of another type of cancer or thyroid malignancy, pregnancy, patients with invasive histopathology PTMC, cardiac pacemaker or metal stent or other implants in the body, undergo bipolar radiofrequency ablation.

The main complication is hoarseness, while the secondary complications are hematoma formation and cough, which can recover after a few months. Research has found that T1a (maximum diameter ≤ 1 cm) and T1b (maximum diameter >1 cm and ≤ 2 cm) have similar prognosis. Therefore, some reports suggest that TA treatment for low-risk T1b PTC can also achieve similar to surgical results. Zhou H.D. et al. [25] recently reported a comparative study between MWA and surgical treatment for clinically isolated T1N0M0 PTC, after a total of 1029

patients receiving MWA or surgical treatment, the results showed that MWA resulted in less blood loss (2 mL vs 10 mL) and a shorter procedure time (23 minutes vs 72 minutes). The rate of major complications was 5.4% in the MWA group and 6.3% in the surgery group. Permanent hoarseness only occurred in the surgery group. For T1a and T1b solitary T1N0M0 PTC, there was no evidence of differences regarding disease progression and major complications between MWA and surgical resection, and this study greatly expands the application of MWA in

the treatment of PTC. For multilocal (≤ 3) T1N0M0 PTC, there is a study that 57 patients included in between October 2016 and December 2020 [25], with a total tumor complete disappearance rate of 43.9%, with 54% in the T1a subgroup and 7.7% in the T1b subgroup. They concluded that MWA is a safe and effective treatment for T1N0M0 multilocal (≤ 3) PTC. However, this study lacks surgical comparison, and due to the lack of a large number of objects, which is still ongoing.

Conclusions

MWA has been widely used as an effective alternative surgical method for treating low-risk PTMC in clinical practice, and it was accepted by patients increasingly. Compared with surgery, it has the advantages of aesthetics, fast recovery, less pain, less bleeding, and the same surgical purpose. Overall, there are relatively few long-term follow-up studies conducted after TA, and further large-scale research is needed on postoperative complications and effects. With the improvement of

indications for TA treatment of PTMC, we believe that many convincing studies will support our hypothesis. The research on solitary and multifocal (≤ 3) T1N0M0 PTC will also achieve breakthroughs in the future. MWA will have greater development prospects in the future. Meanwhile, it is noteworthy that the indications, contraindications, standardized intraoperative procedures and close postoperative follow-up must be rigidly enforced.

References

1. Olson E, Wintheiser G, Wolfe K.M., et al. *Epidemiology of thyroid cancer: a review of the National Cancer Database, 2000-2013*. *Cureus*, 2019; 11(2). [[CrossRef](#)]
2. Zheng L., Dou J.P., Liu F.Y., Yu J., et al. *Microwave ablation vs. surgery for papillary thyroid carcinoma with minimal sonographic extrathyroid extension: a multicentre prospective study*. *European Radiology*, 2023; 33(1): 233-243. [[CrossRef](#)]
3. Zheng L., Dou J.P., Han Z.Y., et al. *Microwave Ablation for Papillary Thyroid Microcarcinoma with and without US-detected Capsule Invasion: A Multicenter Prospective Cohort Study*. *Radiology*, 2023; 220661. [[CrossRef](#)]
4. Jeong S.Y, Baek J.H, Choi YJ, Lee J.H. *Ethanol and thermal ablation for malignant thyroid tumours*. *Int J Hyperthermia*. 2017; 33(8): 938-945. [[CrossRef](#)]
5. Mauri G., Hegedüs L., Bandula S., et al. *European Thyroid Association and Cardiovascular and Interventional Radiological Society of Europe 2021 clinical practice guideline for the use of minimally invasive treatments in malignant thyroid lesions*. *European thyroid journal*, 2021; 10(3): 185-197. [[CrossRef](#)]
6. Orloff L.A., Noel J.E., Stack Jr B.C., et al. *Radiofrequency ablation and related ultrasound-guided ablation technologies for treatment of benign and malignant thyroid disease: An international multidisciplinary consensus statement of the American Head and Neck Society Endocrine Surgery Section with the Asia Pacific Society of Thyroid Surgery, Associazione Medici Endocrinologi, British Association of Endocrine and Thyroid Surgeons, European Thyroid Association, Italian Society of Endocrine Surgery Units, Korean Society of Thyroid Radiology, Latin Head & neck*, 2022; 44(3): 633-660. [[CrossRef](#)]
7. Coca-Pelaz A., Shah J.P., Hernandez-Prera, et al. *Papillary thyroid cancer - Aggressive variants and impact on management: A narrative review*. *Advances in therapy*, 2020; 37: 3112-3128. [[CrossRef](#)]
8. *NHC of the People - Chinese guidelines for diagnosis and treatment of esophageal carcinoma 2018 (English version)*. *Chinese Journal of Cancer Research*, 2019; 31(2): 223-258. [[CrossRef](#)]
9. Li S., Yang M., Guo H., et al. *Microwave ablation vs traditional thyroidectomy for benign thyroid nodules: a prospective, non-randomized cohort study*. *Academic Radiology*, 2022; 29(6): 871-879. [[CrossRef](#)]
10. Cao X.J., Zhao Z.L., Wei Y., et al. *Microwave ablation for papillary thyroid cancer located in the thyroid isthmus: a preliminary study*. *International Journal of Hyperthermia*, 2021; 38(1): 114-119. [[CrossRef](#)]
11. Wu J., Zhao Z.L., Cao X.J., et al. *A feasibility study of microwave ablation for papillary thyroid cancer close to the thyroid capsule*. *International Journal of Hyperthermia*. 2021; 38(1): 1217-1224. [[CrossRef](#)]
12. Cabanillas M.E., McFadden D.G., Durante C. *Thyroid cancer*. *Lancet*, 2016 Dec 3; 388(10061): 2783-2795. [[CrossRef](#)]
13. Pacini F, Castagna M.G., Brilli L, Pentheroudakis G. *ESMO Guidelines Working Group. Thyroid cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up*. *Ann Oncol*, 2012; 23(7): 110-119. [[CrossRef](#)]
14. Maniakas A., Zafereo M., Cabanillas M.E. *Anaplastic Thyroid Cancer: New Horizons and Challenges*. *Endocrinology and Metabolism Clinics*, 2022; 51(2): 391-401. [[CrossRef](#)]
15. Chintakuntlawar A.V., Foote R.L., Kasperbauer J.L., Bible K.C. *Diagnosis and management of anaplastic thyroid cancer*. *Endocrinology and Metabolism Clinics*, 2019; 48(1): 269-284. [[CrossRef](#)]
16. Saini S., Tulla K., Maker A.V., et al. *Therapeutic advances in anaplastic thyroid cancer: a current perspective*. *Molecular cancer*, 2018; 17(1): 14. [[CrossRef](#)]
17. Viola D, Elisei R. *Management of Medullary Thyroid Cancer*. *Endocrinol Metab Clin North Am*, 2019; 48(1): 285-301. [[CrossRef](#)]
18. Kim M., Kim B.H. *Current Guidelines for Management of Medullary Thyroid Carcinoma*. *Endocrinol Metab (Seoul)*, 2021; 36(3): 514-524. [[CrossRef](#)]
19. Moley J.F. *Medullary thyroid carcinoma: management of lymph node metastases*. *J Natl Compr Canc Netw*, 2010; 8(5): 549-556. [[CrossRef](#)]
20. Papini E., Bizzarri G., Pacella C.M. *Percutaneous laser ablation of benign and malignant thyroid nodules*. *Curr Opin Endocrinol Diabetes Obes*, 2008; 15(5): 434-439. [[CrossRef](#)]
21. Muhammad H., Santhanam P., Russell J. O. *Radiofrequency ablation and thyroid nodules: updated systematic review*. *Endocrine*, 2021; 72: 619-632. [[CrossRef](#)]

22. Luo F, Huang L, Gong X, Han Z, Liu F, Cheng Z, Yu J. Microwave ablation of benign thyroid nodules: 3-year follow-up outcomes. *Head & Neck*, 2021; 43(11): 3437-3447. [\[CrossRef\]](#)
23. Haugen B.R, Alexander E.K, Bible K.C, et al. 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer: The American Thyroid Association Guidelines Task Force on Thyroid Nodules and Differentiated Thyroid Cancer. *Thyroid*, 2016; 26(1): 1-133. [\[CrossRef\]](#)
24. Cao XJ, Yu MA, Zhu YL, et al. Ultrasound-guided thermal ablation for papillary thyroid microcarcinoma: a multicenter retrospective study. *Int J Hyperthermia*, 2021; 38(1): 916-922. [\[CrossRef\]](#)
25. Zhou H.D, Yu X.Y, Wei Y, et al. A clinical study on microwave ablation of multifocal (≤ 3) T1N0M0 papillary thyroid carcinoma. *European Radiology*, 2022; 1432-1084. [\[CrossRef\]](#)

ҚАЛҚАНША БЕЗІНІҢ ПАПИЛЛЯРЛЫҚ КАРЦИНОМАСЫНЫҢ ЕМІНДЕГІ МИКРОТОЛҚЫНДЫ АБЛЯЦИЯНЫҢ РӨЛІ: ЖҮЙЕЛІ ШОЛУ

Aili Saiding

Гуаньюань орталық ауруханасының бас дәрігері, Гуаньюань, Сычуань, Қытай. E-mail: 1443197741@qq.com

Түйіндеме

Қалқанша безінің папиллярлық карциномасы (ҚБПК) қалқанша безінің қатерлі ісігінің ең көп таралған түрі болып табылады. Соңғы жылдары адамдарда ҚБПК кездесу жиілігі біртіндеп өсуде. Тиреоидэктомия бірнеше нұсқаулықтардың ұсынуына ҚБПК бар науқастарды емдеуді алдыңғы қатардағы емдеу әдісі болып келді. Бірақ кейбір пікірлер бойынша микротолқынды абляция (MWA) көлемі ≤ 10 мм ҚБПК үшін балама емдеу болуы мүмкін. Яғни MWA тиімділігі мен қауіпсіздігіне қатысты әлі де кейбір қарама-қайшылықтар бар. Сондықтан, бұл жүйелі шолу қазіргі емдеу әдістері мен ҚБПК емдеудегі MWA зерттеулерінің барысы туралы қорытынды жасауға бағытталған.

Тиісті отандық және халықаралық нұсқаулықтар мен соңғы клиникалық зерттеулер негізінде MWA даму жағдайы мен келешегі талқыланды.

Қорытынды. MWA T1N0M0 жалғыз папиллярлы қалқанша безінің карциномасын емдеуде артықшылықтарға ие. Дегенмен, MWA хирургиясында ҚБПК (өлшемі - >10 мм) және мультифокальды ҚБПК (өлшемі - ≤ 10 мм) кезінде даулы сұрақ болып қала береді.

Түйін сөздер: қалқанша безі, папиллярлық карцинома; операция; микротолқынды абляция; жүйелі шолу.

РОЛЬ МИКРОВОЛНОВОЙ АБЛЯЦИИ В ЛЕЧЕНИИ ПАПИЛЛЯРНОГО РАКА ЩИТОВИДНОЙ ЖЕЛЕЗЫ: СИСТЕМАТИЧЕСКИЙ ОБЗОР

Aili Saiding

Главный врач Центральной больницы Гуаньюань, Сычуань, Китай. E-mail: 1443197741@qq.com

Резюме

Папиллярная карцинома щитовидной железы (ПРЦЖ) является наиболее распространенным типом рака щитовидной железы. В последние годы заболеваемость ПРЦЖ у человека постепенно увеличивается. Тиреоидэктомия была лечением первой линии для ПРЦЖ, рекомендованным несколькими руководствами, но были предложены некоторые мнения о том, что микроволновая абляция (MWA) может быть альтернативой лечению ПРЦЖ размером ≤ 10 мм, все еще существуют некоторые разногласия относительно эффективности и безопасности MWA. Таким образом, этот систематический обзор был направлен на заключение о текущем статусе лечения и прогрессе исследований MWA в лечении ПРЦЖ.

На основе соответствующих отечественных и международных руководств и последних клинических исследований обсуждались состояние развития и перспективы MWA.

Выводы. MWA имеет преимущества в лечении солитарной папиллярной карциномы щитовидной железы T1N0M0. Однако РТС (размер - >10 мм) и многоочаговый ПРЦЖ (размер ≤ 10 мм) остаются спорными при хирургии MWA.

Ключевые слова: щитовидная железа, папиллярная карцинома; операция; микроволновая абляция; систематический обзор.