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**Research Article**

# Efficiency of Radiofrequency Ablation in Treatment of Thyroid Nodules in Iraqi Patients with Nodular Goiter

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**Abstract**

***Background***: Radiofrequency ablation (RFA) is a minimally invasive, non-surgical procedure that decreases nodular size and is efficient for symptomatic benign nodules. It is safer, has no scars, has quicker recovery time, and lacks the risk of permanent hypothyroidism compared to surgery. ***Objective***: to present the effects of RFA in reducing the volume of thyroid nodules and improving patients' symptoms. ***Methods***: In a prospective study**,** twenty patients with symptomatic thyroid enlargement were evaluated in the Kahramana Medical Center of Interventional Radiology from January to December 2023, using the SURGNOVA system under local anesthesia after detailed neck ultrasonography using the Samsung HS50 machine. The patients were discharged after an hour of resting and applying an ice pack to their neck. ***Results***: From the twenty individuals included, the most common symptom overall was neck swelling in 60%, which was followed by positional cough in 8 cases (40%) and dysphagia in 4 cases (20%). The nodules ranged in size from 4.4 to 166 ml. Six months after the procedure, all patients' symptoms improved. The nodule volume reduction after six months' follow-up ranges from 50 to 88% of the initial volume, with 80% reporting >70% volume reduction following a single ablation session. There are no notable alterations in basal thyroid function. ***Conclusions***: In comparison with surgery, thermal ablation for nodular goiter is a very effective and secure alternative. It is especially helpful for patients who want to keep their thyroid gland and refuse surgery; it has few adverse effects and high technical success.

***Keywords***: Iraqi patients, Nodular goiter, Radiofrequency ablation, Thyroid nodules.

**كفاءة الاستئصال بالترددات الراديوية في علاج عقيدات الغدة الدرقية لدى المرضى العراقيين المصابين بتضخم الغدة الدرقية العقدي**

**الخلاصة**

**الخلفية**: العلاج بالترددات الراديوية (RFA) هو إجراء طفيف التوغل وغير جراحي يقلل من حجم العقيدات وفعال في العقيدات الحميدة المصحوبة بأعراض. إنه أكثر أمانا، وليس له ندوب، وله وقت تعافي أسرع، ويفتقر إلى خطر الإصابة بقصور الغدة الدرقية الدائم مقارنة بالجراحة. **الهدف**: بيان آثار RFA في تقليل حجم عقيدات الغدة الدرقية وتحسين أعراض المرض. **الطرائق**: في دراسة مستقبلية، تم تقييم عشرين مريضا يعانون من تضخم الغدة الدرقية المصحوبة بأعراض في عيادة كهرمانة للأشعة التداخلية للفترة من يناير الى ديسمبر 2023، باستخدام جهاز SURGNOVA تحت التخدير الموضعي بعد التصوير بالموجات فوق الصوتية التفصيلية للرقبة باستخدام جهاز Samsung HS50. غادر المرضى العيادة بعد ساعة من الراحة ووضع كيس ثلج على رقبتهم. **النتائج**: من بين عشرين فردا، كانت أكثر الأعراض شيوعا بشكل عام هو تورم الرقبة في 60٪ ، تلاه السعال الموضعي في 8 حالات (40٪) وعسر البلع في 4 حالات (20٪). تراوحت العقيدات في الحجم من 4.4 إلى 166 مللتر. بعد ستة أشهر من العملية، تحسنت جميع أعراض المرضى. ويتراوح انخفاض حجم العقيدات بعد متابعة ستة أشهر من 50 إلى 88٪ من الحجم الأولي، حيث أبلغ 80٪ عن انخفاض في الحجم بنسبة >70٪ بعد جلسة كي حراري واحدة. لا توجد تغييرات في وظيفة الغدة الدرقية الأساسية. **الاستنتاجات**: بالمقارنة مع الجراحة، يعد الكي الحراري لتضخم الغدة الدرقية العقدي بديلا فعالا وآمنا للغاية. إنه مفيد بشكل خاص للمرضى الذين يرغبون في الحفاظ على الغدة الدرقية ورفض الجراحة، مع آثار سلبية قليلة ونجاح تقني عالي.

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## INTRODUCTION

One of the most prevalent thyroid conditions is thyroid nodules, which affect 4-6 percent of the general population [1]. To determine the risk of malignancy, a combination of clinical data, ultrasound imaging, and FNAC (fine needle aspiration cytology) is required, even though it is believed that 95% of thyroid nodules are benign and just 4.0–6.5% are malignant [2]. The basis for the anatomic evaluation of the thyroid gland is the ultrasound examination. The nodule's composition, echogenicity, shape, borders, and presence of calcifications all contribute to its overall characteristics. Based on these features, several groups have created risk stratification methods to determine if a nodule is benign or cancerous. TI-RADS, a thyroid image recording data system, is typically used to accomplish this [3]. When treating thyroid nodules with a concerning cytologic

diagnosis, compressive symptoms, or autonomous function, surgical excision has long been the gold standard. Nevertheless, there are dangers associated with surgery that can outweigh the advantages of treating benign nodules and indolent cancers. Risks associated with partial or complete thyroidectomy include cosmesis, infection, bleeding, hypocalcemia, and recurrent laryngeal nerve damage. Thus, research into less intrusive methods is necessary [7–10]. To treat thyroid nodules, several minimally invasive nonsurgical techniques have been developed, such as microwave ablation (MWA), radiofrequency ablation (RFA), laser ablation (LA), and ethanol ablation (EA) [6]. RFA creates an electrical current through a target tissue (thyroid nodule) with heat generated secondary to frictional forces at the ionic level and increases with tissue impedance, increased magnitude of the current, and increased current flow time [4]. Since 2006, the RFA method has been used to treat thyroid nodules and has been reported to have good efficacy and safety for treating benign thyroid nodules and recurrent thyroid cancer. Excessive heat causes intracellular proteins to coagulate, which causes cell malfunction and eventually cell death. This condition is commonly referred to as coagulation necrosis [5]. When surgery is declined or the patient is unable to tolerate surgery, thermal therapy (RFA) is recommended for the treatment of benign nodules that are symptomatic and nodules that function independently. This study aims to evaluate the effectiveness of RFA in treating Iraqi patients' symptomatic nodular goiter.

## METHODS

### *Study design and patient selection*

This prospective study included fifty patients with symptomatic nodular goiter who complained of pressure sensations, dysphagia, postural cough, and neck swelling from January 2023 to December 2023 at Kahramana Medical Center of Interventional Radiology. Their ages varied from 28 to 68 years old.

### *Inclusion criteria*

Patients who meet the eligibility requirements include those who meet the radiological features of benign nodules on a neck ultrasonography, have symptoms, underwent fine needle aspiration cytology (FNAC), and have results from two lab tests that indicate a benign cytology—Bethesda II score.

### *Exclusion criteria*

Histological Bethesda III and above, non-nodular goiter, and smaller thyroid nodules measuring less than 20 mm and being completely cystic by ultrasound were included. Those patients with cardiac-inserted electrical devices and who were pregnant were excluded from the study.

### *Intervention and outcome measurement*

Every patient will get a neck ultrasound examination by a qualified interventional radiologist, who will report the volume, location, number, and texture of targeted nodules. After that, the patients will be ready to undergo FNAC under ultrasound guidance. Each patient underwent three needle passes, and the slides were sent to two labs in anticipation of the Bethesda score. On the procedure day the patient lies down on the operating table, with their neck fully stretched and fully exposed, earth pads fastened to their thighs, and povidone iodine used to sterilize their neck. Ablation technique: the cooling system is turned on, the RFA electrode settles to the SURGENOVA device, local anesthetic is prepared with 7 ml of 2% lidocaine, 3 ml of sodium bicarbonate, and 10 ml of 5% dextrose water, and it is injected under the ultrasound guide, completely encircling the targeted lobe. After cutting a tiny gap in the skin with a blade-11 and inserting the RFA electrode through the isthmus into the closest and deepest area of the nodule, the device power was adjusted to 15, 30, or 45 watts based on the electrode's active tip, which is 5 mm, 7 mm, or 10 mm, respectively, and according to nodule size. Next, with the moving shot approach, the ablation is initiated and continues until the entire nodule volume is covered. Each session involved the treatment of a single lobe nodule, with a second lobe slated for a month later. After turning off the machine, removing the electrode, and cleaning the skin, an ice pack is applied to the patient's neck, and the patient is monitored for an hour. After being monitored for around 1 hour, the patient was given a follow-up date (six months or longer) and, if necessary, oral non-steroidal anti-inflammatory medication to take home.

### *Ethical considerations*

The Ethical Committee at the University of Baghdad approved the study protocol. Oral consent was obtained from each patient before participation. Confidentiality was considered regarding the collected data.

### Statistical analysis

All data were analyzed using the Statistical Package for Social Sciences (SPSS) version 29. Descriptive statistics were presented as mean ± standard deviation, frequencies, and percentages.

## RESULTS

Twenty individuals (mean age of 45) with ages ranging from 28 to 68 years old had thyroid nodules. Most of these patients—15 females and 5 males—were over thirty. They all complained of neck swelling, four of

them had dysphagia, eight had positional coughs, and 12 had cosmetic issues. Tables 1 and 2 display the details of the age, gender, and symptoms.

**Table 1**: the age groups and gender of included patients.

| ***Age*** | Number (%) |
|---|---|
| <30 | 1(5) |
| 30-39 | 6(30) |
| 40-50 | 7(35) |
| >50 | 6(30) |
| Total | 20(100) |
| ***Gender*** | |
| Females | 15(75) |
| Males | 5(25) |
| Total | 20(100) |

**Table 2**: The symptoms presented by participated patients

| Symptoms | No. (%) |
|---|---|
| Neck swelling | 20 (100) |
| ***Additional symptoms*** | |
| Cosmetic | 12 (60) |
| dysphagia | 4(20) |
| Postural cough | 8 (40) |

The nodules volume was divided into three categories: small (20 ml or less), medium (20 to 100 ml), and large (more than 100 ml). Figure 1 shows the details on each size.

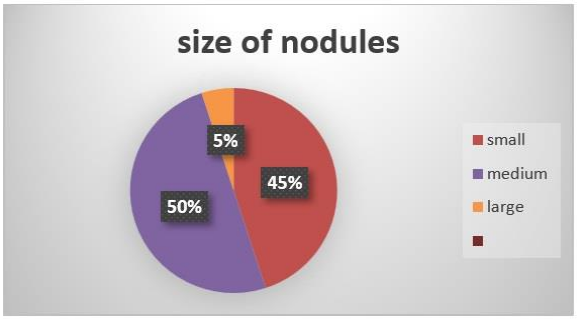


**Figure 1**: The size of nodules in the included patients.

Regarding the volume decrease of treated nodules in our patients, Figure 2 shows that, six months following radiofrequency ablation, 80% of patients' nodules reduced to less than 70-88% of their initial size, while the remaining 20% had a volume reduction of 50-68%.

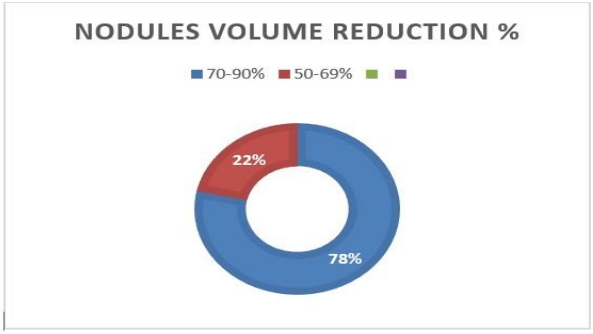


**Figure 2**: Volume reduction of ablated nodules 6 months later.

All cases showed better symptoms, regardless of whether they were pressure- or cosmetic-related (*p*-value= 0.0004), and many cases showed a percentage of nodule volume decrease between 70 and 88% of initial pre-ablation size. Almost all patients experienced no significant problems; however, one patient experienced cutaneous ecchymosis, which resolved satisfactorily in a few days. An example of a case that underwent RFA of a thyroid nodule is shown in Figure 3.

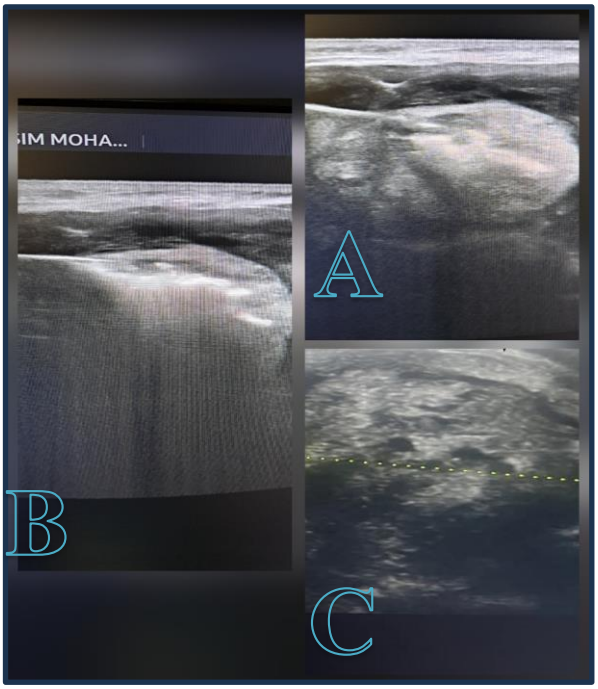


**Figure 3**: A patient with large left lobe thyroid nodule =25ml underwent radiofrequency ablation underwent under the ultrasound guide. **A**) early in ablation session, **B**) near the end of session, and **C**) 3 months after ablation showing decreasing size to 4ml and decreasing echogensity.

## DISCUSSION

Nodular goiter has been becoming more common in recent years, although opinions on how to treat it have been divided [11]. Thus, some clinicians have recommended surgery; nevertheless, following nodule removal, patients frequently develop neck scars or hypothyroidism, which has a severe negative impact on their quality of life [12]. Minimally invasive options have been investigated since there are additional concerns, such as the potential for postoperative parathyroid function problems and general anesthetic hazards [13]. Nodular goiter can be safely and effectively treated by ethanol ablation, laser ablation, microwave ablation, and radiofrequency ablation (RFA) [14]. Thyroid ablation has numerous benefits, the primary being that it is a minimally invasive procedure that may be performed as an outpatient technique because it doesn't require large incisions or general anesthesia, has no serious side effects, and is affordable [15]. Second, RFA reduces damage to normal thyroid tissue because the radiofrequency electrode only travels inside the targeted nodule. Additionally, owing to its short recovery time, most patients can return to work and

other regular activities in a few hours [16]. The nodule volume reduction in our study ranged from 70 to 90 percent, which is similar to the average reduction of 75 percent after six months' follow-up that Che *et al*. found [16]. Our findings were consistent with those of studies conducted by Jeong *et al*. and Lim *et al*. [17,15,18] regarding the major problems and changes in thyroid function tests.

## Study limitations

Radiofrequency ablation was technically not suitable for patients with severe cervical spondylopathy who cannot withstand sleeping supine, those with cardiac pacemakers or defibrillators, and pregnant ladies.

## Conclusion

When used in lieu of surgery, radiofrequency for nodular goiter is a very effective and secure therapeutic alternative. It is especially helpful for patients who want to keep their thyroid.

### Conflict of interests

The authors declared no conflict of interest.

### Funding source

The authors did not receive any source of funds.

### Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

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