



Short Communication

Radiofrequency ablation for management of thyroid nodules in quarantine zone of COVID-19 pandemic setting in Indonesia

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ABSTRACT

Surgery using minimally invasive procedures has been continuously developing in the medical field including in the treatment and resection of thyroid tumors. In addition to open thyroid surgery, several types of procedures are well developed and adopted in our center including the endoscopic thyroid and radiofrequency ablation (RFA). The COVID-19 pandemic has substantially changed the healthcare system in Indonesia. Lack of oxygen and hospital wards, unaffordable screening tests, and limited health workers affect the perpetuation of non-emergency healthcare service including in the management of thyroid nodules. To preserve the resources needed during the pandemic, PFA for the thyroid procedure provides a better option in terms of hospital bed availability, healthcare cost, and patients' emotional distress. We safely conducted RFA procedures during the period of quarantine levels of 1–3 (low to high) by implementing COVID-19 protocols without any significant postoperative complications.

1. Introduction

Thyroid nodules are the most common diseases in the endocrine system. The prevalence of clinically apparent thyroid nodules is 6.4% in women and 1.5% in men [4]. Palpable thyroid nodules occur in 4–7% of the population, but nodules found incidentally on ultrasonography suggest a prevalence of 19–67% [6,7]. Most thyroid nodules are asymptomatic and only about 5% of all palpable nodules are found to be malignant [5]. Among the thyroid carcinomas, 94.4% are differentiated cancers of papillary or follicular thyroid cancer. Therefore, the probability of getting poorly differentiated thyroid cancer is less than 1% [8–10] (See Table 1, Figs. 1 and 2)

Treatment of thyroid nodules requires several steps. For the initial diagnostic procedures, we apply the American Thyroid Association (ATA) guidelines using ultrasound with the Thyroid Imaging Reporting and Data System (TIRADS) scoring system [11]. Fine Needle Aspiration (FNA) is performed according to the ultrasonography risk stratification and the results are reported according to the Bethesda system. In inconclusive cases, a core biopsy is performed. Diagnostic surgery or ismolebectomy is performed for nodules with doubtful results using core

biopsies. We implement the Korean Society guidelines for thyroid ablation and core biopsy [12,13] and radiofrequency ablation (RFA) is performed for benign nodules.

2. Thyroid treatment

2.1. Open surgery

At our center, open thyroid surgery has been traditionally performed for decades for treatment of both benign and malignant thyroid nodules. Several open thyroid techniques that have been commonly used are subfascial approach (cutting the anterior jugular vein and lifting the fascia by maintaining the strep muscle1) [1], minimal access thyroid surgery (a small incision about 3–4 cm for small thyroid nodules) [2,3], and lateral approach [14] (the approach through the edge of the omohyoid muscle and not exposing the midline of the strep muscle). The sub-platysma approach is performed by maintaining the anterior jugular vein along with the fascia entering through the midline of the strep muscle.

In open thyroid surgery, the patient usually stays in the hospital for a

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Table 1
The comparison of all aspects that are considered in performing several actions for thyroid.

	Open	Endoscopy	RFA	EA
Blood exposure	****	**	*	*
Size	Any size	5 cm	Any size	Any
Malignant	Every pathological	Small	L risk	No.
Benign	All	5 cm	Papillary	Cyst
Team	6p	5p	3p	2p
Time procedure	90'	150'	60'	30'
Complication	2%	4%	0%	0%
Preparation	15'	30'	5'	1'
General Anesthesia	Yes	Yes	No	No
Room procedure	Operating room	Operating room	Outpatients	Outpatients
Oxygen needed	Yes	yes	No	No
Type of care	Inpatients	Inpatients	Outpatients	Outpatients
Tissue taken	All tissue	Almost all tissue	Leave	Leave

minimum of 3 days, involving 1 day of preoperative preparation and 2 days for postoperative monitoring and recovery. In open surgery, general anesthesia is required and the time of surgical procedure is around 90–150 min or even longer if there are complications, difficulty, or with neck dissection. The open thyroid surgery requires a team of six people consisting of an operator, two assistants, an instrument nurse, an anesthesiologist, and a circulator. Patients needing general anesthesia including those with benign thyroid nodules are usually operated on a queue basis during the COVID-19 pandemic.

2.2. Endoscopy thyroid surgery

Another technique used at our center is endoscopic thyroid surgery which also needs a minimum hospital stay of three days. The patient is hospitalized for preoperative preparation. Endoscopic thyroid surgery takes longer than open thyroid, which is about 120–240 min for complex cases. General anesthesia is also required. The endoscopic thyroid

surgery can be performed only on nodules less than 5 cm. Similar to the open surgery, the endoscopic surgery team consists of five people including an operator, a cameraman, an instrument nurse, a circulator, and an anesthesiologist. The advantages of endoscopy are minimal incision and the scar that can be hidden behind the axilla. In our experience of 20 cases, only 1 case had an external jugular vein laceration which could be well managed with clip closure.

2.3. RFA

RFA in thyroid nodules is commonly used for the treatment of benign thyroid nodules. Recently, several studies have described the use of RFA techniques in low-risk malignant thyroid nodules. Before the introduction of RFA in 2019 for thyroid nodules, our center often treated the thyroid using an open technique. Since 2017, endoscopy thyroid surgery has been performed for smaller nodules. RFA provides different aspects from open and endoscopic thyroid surgery. The RFA can be performed outside the main operating theater under local anesthesia that can spare the use of oxygen, anesthetic drugs, and hospital beds. We can simply use a room equipped with a vital sign monitor. Patients can also be immediately discharged after 1 h of observation. The procedure is also very short, lasting about 30 min for a single nodule less than 4 cm although bigger and multiple nodules might require longer procedures [17]. The PRA procedure also requires a smaller number in the operating team, namely an operator, an assistant, and a circulator. Additionally, the RFA procedure can also provide very good results in terms of nodule resolution, cosmetic aspects, and patient satisfaction. The thyroid nodule will usually regress after the procedure with minimal complications. Out of 30 cases in our center, only 1 patient experienced temporary hoarseness that improved within 10 days without any specific treatment [23].

2.4. Ethanol ablation

Another treatment for thyroid lumps is ethanol ablation. This procedure is very simple because it is performed in a polyclinic with an outpatient setting and only takes 30 min. It is usually done by the

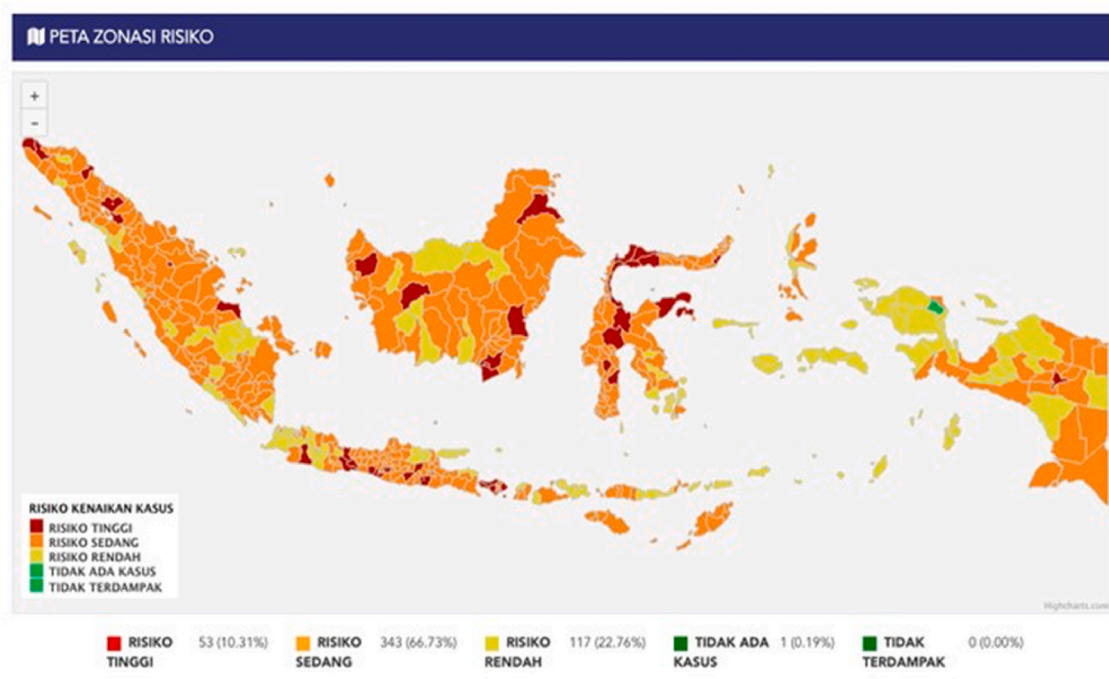


Fig. 1. The quarantine zoning imposed in Indonesia in mid-2021 [20].

operator with an assistant and a circulator using local anesthesia. The procedure usually provides very minimal complications. However, it can be performed only in cases of a simple cystic thyroid nodule. In patients with mixed patterns of thyroid nodules, ethanol ablation can be performed before RFA as a combination [24,25].

3. Indication of thyroid surgery is divided into several groups according to its urgency

3.1. Urgent surgery must be done as soon as possible because even a short deferral could be life-threatening

Urgent thyroid surgery is required for patients with the diagnosis of thyroid emergencies, including anaplastic thyroid cancer that blocks the airway or potentially grows aggressively. Goiters that cause severe compressive symptoms (inspiratory dyspnea due to tracheal compression, dysphagia due to esophageal compression, superior vena cava syndrome) must also be prioritized for urgent surgery even in the midst of the COVID-19 pandemic. In addition, metastatic thyroid cancer that needs further treatment, large malignant thyroid cancer, and suspected malignant nodule with biopsy result of Bethesda IV should also be prioritized for urgent surgery.

3.2. Semi-urgent surgery can be deferred for a few weeks but not beyond 3 months without any compromise in the functional prognosis

Included in the semi-urgent group are patients with thyroid nodules including specific situations e.g., thyrotoxicosis (Graves's disease, toxic nodules, toxic goiters, and iatrogenic hyperthyroidism) that is resistant to or is poorly controlled by anti-thyroid (SAT) therapy. A thyroid tumor suspected of malignancy (Bethesda 5 or 6) must be discussed at a multidisciplinary team (MDT) meeting. When there are clinical or pre-clinical signs of an aggressive form of cancer (recurrent nerve palsy, local invasion with esophageal, vascular or tracheal involvement, and/or massive lymph nodes infiltration [21]), semi-urgent surgery must be planned.

3.3. High-priority elective surgery can wait for several months but must be given scheduling priority as soon as the epidemic is over

The tumors with size more than 2 cm, with no sign of life-threatening condition are placed in this group.

3.4. Distant elective surgery can be deferred until after the epidemic is over, even more than 6 months, without compromising the prognosis [21]

Distant elective surgery is performed for small cancerous tumors less

than 2 cm with no lymph nodal spread and no clinical indications of urgent surgery including a benign nodule, annoying nodule, and cosmetic complaints [16].

In our center, most patients with thyroid lumps present with very large tumors. The largest tumor was 170 cc while the smallest was 5.7 cc with the average 85 cc [17]. The patients will come to the doctor if there are symptoms such as difficulty swallowing, pain, uncomfortable feeling, etc. They usually come with high anxiety and panic about the disease. They generally want immediate action after feeling the lump in the throat getting bigger and causing other symptoms.

4. The impact of COVID-19 on Indonesian national healthcare

The Coronavirus Disease 2019 (a.k.a. COVID-19) was initially detected in Indonesia in March 2020. The COVID-19 transmission spread very quickly and disrupted the healthcare system. During the preparation of this manuscript, Indonesia ranked 14th of the highest cases of COVID-19 worldwide with a total confirmed case count of 4,258,980. Total deaths were 143,929 as the 7th highest in the world. We experienced two COVID-19 waves in January and July 2021 [18]. Indonesia also had the highest number of health worker deaths in Asia. As of August 17, 2021; 1,891 health workers died during the COVID-19 pandemic including 640 doctors, 637 nurses, 377 midwives, 98 dentists, 34 nutritionists, 33 laboratory technologists, and 13 public health experts. In fact, the ratio of doctors to the population in Indonesia is 4:10,000, while according to the World Health Organization (WHO), ideally, 1 doctor serves 1,000 people [15].

Under these circumstances, Indonesia faces several problems.

- Expensive polymerase chain reaction (PCR) test;
- Long waiting time for PCR test results;
- Inaccurate rapid testing due to inexperience;
- Frequent fatigue among health workers;
- Full bed occupancy; and
- Some centers ran out of oxygen stock [22,23].

In dealing with this pandemic, the Indonesian government has imposed a regional quarantine. The government determined there are 4 levels of quarantine.

4.1. Level 1 (green)

The activity is normal, surgery is elective, and urgent action is allowed. Long-duration surgery and cosmetic and reconstructive surgery can also be done. In this situation we can offer thyroid patients some of management treatments including open thyroid, endoscopic thyroid surgery and RFA thyroid.

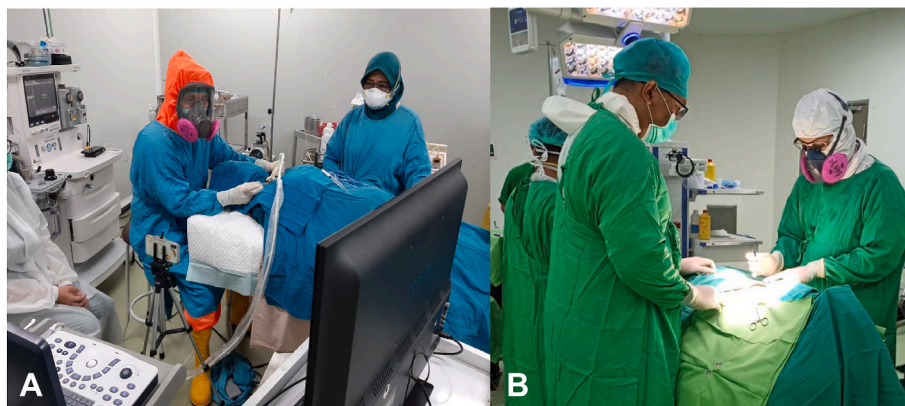


Fig. 2. 2A. RFA process with PPE and in the operating room under negative pressure during the quarantine level 3. 2B. Thyroid open Surgery during public activity restriction level 3 with PPE.

4.2. Level 2 (yellow)

In level 2, the number of positive confirmed cases of COVID-19 is around 20 and less than 50 people per 100,000 population per week. The hospitalization is around 5 and less than 10 people per 100,000 population per week. The death rate due to COVID-19 is less than two people per 100,000 population. In level 2, our center still can perform thyroid surgery for urgent and emergency elective cases.

Despite the need for restrictions such as the number of operating teams, a reduction in the number of elective surgeries, a reduction in operating time and delays in surgery with a long duration, a reduction in the use of beds/inpatient rooms, and taking a COVID test immediately before the action, with some modifications, we can still perform the procedure in patients with thyroid nodules. For endoscopic procedures, some studies recommend a delay. All operating room personnel must use full personal protective equipment (PPE) and N95 masks. If the operation produces smoke, a smoke evacuator can be used.

4.3. Level 3 (orange)

This level is for an area that has several positive confirmed cases of COVID-19 between 50 and 100 per 100,000 people per week. The hospitalization is 10–30 people per 100,000 people per week. The death rate due to COVID-19 is 2–5 people per 100,000 population.

In this level, the treatment of patients with thyroid nodules is more or less like in level 2 with some increasing number of cases per day. Thyroid procedures are possible but with minimal amounts considering the limited availability of inpatient rooms, oxygen, and health workers.

4.4. Level 4 (red)

Level 4 indicates that an area has several positive confirmed cases of COVID-19 of more than 150 people per 100,000 population per week. The hospitalization is more than 30 people per 100,000 population per week with a death rate of more than 5 people per 100,000 population [19]. We are unable to perform any of the elective procedures. In hospitals, we can only handle emergency cases and life-threatening patients. For thyroid cases, only bleeding, abscess or infection, and thyroid tumors that suppress the airway, or an airway compromised were handled. Under quarantine level 4, surgery could only be performed on a malignant or threatening thyroid tumor or thyroid infection. Thyroid infection management could be done in an emergency or urgent condition. At level 4, our center stopped all elective operations; health workers focused on handling the COVID-19 pandemic while oxygen stock, treatment rooms, and intensive care units (ICU) were used for treating patients with COVID-19, so all thyroid patients had to wait until the situation improved. The only other thyroid surgery to be done at that time was for thyroid emergency or urgent surgery, namely thyroid suppressing the airway, thyroid abscess, and anaplastic thyroid.

5. The impact of COVID-19 pandemic on thyroid procedures

During this pandemic, some patients have been put in a queue for non-emergency and non-essential procedures. After the patient had been educated about the procedure and the risks of the intervention in the midst of the pandemic situation, the patients could proceed to the RFA procedures. For open thyroid surgery, there is a risk of exposure from the patient to health workers through blood even though we have used PPE and N95 masks. There might also be the transmission of saliva from the patient to the anesthesiologist during intubation before surgery. There could also be exposure from health workers to patients in a room that we minimized the risk of transmission with the use of masks and complete PPE.

We do not offer thyroid endoscopy to patients during the levels 2 and 3 in the pandemic. As an alternative procedure, we offer an RFA which was found to be well received by the patients. There is a risk of RFA

infection because the operator sits very close to the patient for more than 30 min. This risk must be prevented by covering the patient's nose or mouth. Thus, apart from the operator, we ask the patient to be willing to wear an N95 mask during the procedure. RFA is preferable by the patient since this procedure is incision-free, so it does not leave scars and does not require hospitalization. For patients who are afraid of surgery, this procedure is a treatment of choice. The disadvantage of this procedure is that it is not covered by public insurance, but, for private insurance and private patients, this is the main preferred choice. Moreover, during the periods of partial lockdown, patients are unwilling to get the treatment that requires a long hospital stay; and the health workers are also reluctant to give treatment in this setting. Every patient must have already passed several screenings including rapid antigen testing, no fever, good chest X-ray results and no clinical signs of infection.

Although in the classification of procedures, non-malignant or non-life-threatening thyroid tumor is included in the high priority, treatment can still be done at level 3 (orange). Previously, in levels 2 and 3, we only handled semi-urgent and urgent cases because along with health workers and health facilities, both rooms and oxygen were focused on COVID-19 cases. However, patients with enlargement of the thyroid became more worried because "When will this pandemic end?" is still a big question beside "Do we need to wait for the pandemic to end? In level 4, patients with benign thyroid tumors were not allowed to visit the hospital, so they were worried about the enlargement of their tumors if they were only at home, and were urgently seeking management of their thyroid after the quarantine level getting lower in levels 3 or 2. The difficulty in answering these questions prompted thinking of taking action on thyroid nodules during lockdown with the low levels of 2 and 3 while practicing the health protocol. In response to requests, we treated these thyroid nodules at the patient's agreement.

For this open thyroid action, during the pandemic, we are still working on malignant tumors with full PPE and reducing 1 team member. The team consists of an operator, an assistant, an instrument nurse, a circulator, and an anesthesiologist, so there are 6 people, including the patient, in the operating room. For the duration of this surgery, it is difficult to reduce this number because, for safety procedures and patient safety, there is a standard operating procedure to fulfill. All team members must use full PPE. For this open surgery, we use general anesthesia, inpatient rooms, and oxygen, so we must look at the availability of health workers and oxygen in our facilities. In addition to the ultrasound examination on FNA and thyroid function, the patient also will undergo routine blood, blood clot, liver function, kidney function, echocardiogram, and blood sugar checks, as well as infection and COVID-19 screening. In addition to a complete laboratory, for anesthesia, 6-h fasting before the procedure is also required.

We offered ablation for patients with large benign tumors and high concern with a very minimum team of an operator and an assistant without a circulator. Only three people were in the room, including the patient. The alternative solution for patients requiring immediate or urgent surgery is through RFA. During the pandemic, non-essential elective surgeries are deferred to preserve hospital resources for the COVID-19 and emergency care. In open and laparoscopic surgery procedures for thyroid lesions, intubation is required for the anesthesia. Intubation is an aerosol-generating procedure that causes a higher risk of hospital COVID-19 transmission. Because RFA procedures require local anesthesia, it poses a lower risk of transmission. In terms of health expenses, RFA also offers several advantages including outpatient surgery setting without need of hospitalization thus increasing hospital bed availability. In addition, RFA also provides some patient's psychological advantages by providing less emotional distress due to general anesthesia, no prolonged hospitalization, less potential pain, bleeding, and increased wound healing.

RFA ablation is an ideal treatment during the pandemic since it does not require modification in the COVID-19-free surgical pathway. The procedure can be done only by an operator and an assistant. All

personnel can keep practicing the closed/protected health protocol. In addition, this procedure does not require hospitalization and special oxygen supplies, unlike the open thyroid surgery which requires oxygen, an inpatient room, and a large number of health workers. To speed up the generator ablation procedure, we can also set it to high power. For health worker protection, the room is equipped with negative pressure, and as in the operating room, adequate PPE clothing can also be implemented. For preoperative preparation, in addition to ultrasound, FNA, and thyroid function tests, the patient should also have a routine blood, clotting, and blood glucose tests as well as COVID-19 testing. In the end of 2020, Indonesia already had provided affordable PCR tests for COVID-19. In our experience, we performed follow-up for 25 patients with RFA and post-operative COVID-19 transmission as well as complications were not observed. Previous studies also showed that hospitalization and sick leaves were significantly lower in thyroid procedures using RFA in comparison to the open and laparoscopic surgeries. RFA was also better in the quality-adjusted life-years (QALYs) although it was slightly more expensive in term of the investment in the new devices. Health worker personals needed to perform RFA procedures compared to open and laparoscopic thyroid surgeries although additional training, experiences, and certification were required not only to perform the RFA but also to maintain the devices. Although RFA is potentially used during the pandemic, it should be kept in mind that the procedure is an alternative method to address benign thyroid nodules with some shared potential complications. RFA is not recommended for malignant thyroid nodules. Patient education is required before the procedure to discuss about the RFA, expected results, potential benefits and complications, as well as the follow-up and monitoring after the procedure. Inter-professional collaboration and communication among the surgeon, nurses, and technicians are required to perform a successful RFA procedure.

6. Conclusions

The RFA is an effective and safe procedure during the COVID-19 pandemic for both the patients with benign thyroid nodules and health workers with several advantages in terms of sparing hospital human resources, improving patients' quality of life, and lowering costs.

Ethical approval

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Author contribution

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Declaration of competing interest

Authors have declared that they have no potential conflicting interests.

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