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Radio-Guided Excision of Metastatic Lymph Nodes in Thyroid Carcinoma: A Safe Technique for Previously Operated Neck Compartments

Yeşim Erbil · Serkan Sarı · Orhan Ağcaoğlu · Feyzullah Ersöz · Adem Bayraktar · Artür Salmaslıoğlu · Osman Gozkun · Işık Adalet · Selçuk Özarmağan

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Abstract

Background Better follow-up of patients with papillary thyroid cancer (PTC) and more sensitive detection leads to detection of recurrences in the neck. Despite excellent outcomes, the major challenge is controlling locoregional recurrence. We aimed to investigate whether the radio-guided excision of metastatic lymph nodes makes it possible to find the affected lymph nodes in patients with previously operated neck compartments.

Method This prospective study included 46 patients with recurrent/persistent PTC who had previously undergone operation of the neck compartment. Prior to operation, the pathologic node was localized by ultrasound (US) and radiotracer (^{99m}Tc-labeled rhenium colloid) was injected directly into the pathologic node. Careful dissection was carried out following the area of maximum radioactivity until the metastatic lymph node(s) were identified and excised.

Result One affected lymph node was removed in 17 patients, and more than one lymph node (affected or additional nodes) was removed in 29 patients. The median count from the lesion was significantly higher than values from the lesion bed (background activity) (16,886 counts/20 s versus 52 counts/20 s; $p < 0.001$). During follow-up, four patients were lost to follow-up and 27 patients had negative US and basal thyroglobulin (Tg). Five patients had suspicious lymph nodes on the operated side. Although the basal Tg level remained above the normal limit, moderately high in 8 patients, no metastases were detected in the neck.

Conclusions Radio-guided excision of metastatic lymph nodes can be performed safely for the detection and excision of recurrent thyroid cancer in the central and lateral neck.

Y. Erbil (✉) · S. Sarı · O. Ağcaoğlu · F. Ersöz · A. Bayraktar · O. Gozkun · S. Özarmağan
Department of General Surgery, Istanbul University, Istanbul Medical Faculty, Çapa, İstanbul, Turkey
e-mail: yerbil2003@yahoo.com

S. Sarı
e-mail: drserkansari@yahoo.com

O. Ağcaoğlu
e-mail: orhanagcaoglu@hotmail.com

F. Ersöz
e-mail: feyzullahersoz@gmail.com

A. Bayraktar
e-mail: dradem61@gmail.com

O. Gozkun
e-mail: osmangozkun@gmail.com

S. Özarmağan
e-mail: ozarmagan@hotmail.com

A. Salmaslıoğlu
Department of Radiology, Istanbul University, Istanbul Medical Faculty, Çapa, İstanbul, Turkey
e-mail: artur@superonline.com

I. Adalet
Department of Nuclear Medicine, Istanbul University, Istanbul Medical Faculty, Çapa, İstanbul, Turkey
e-mail: adaleti@istanbul.edu.tr

Introduction

Papillary thyroid carcinoma (PTC) is the most common thyroid malignancy. Although PTC has an excellent prognosis, lymphatic spread is associated with increased risk of locoregional recurrence, and the central compartment of the neck is the most frequently involved area [1, 2]. Ultrasonography (US) provides the highest sensitivity to

detect and localize cervical nodal metastasis in most patients. When lymph node metastases are evident clinically either on physical examination or US, surgical excision or neck dissection is the best form of treatment [2, 3].

Reoperation of the neck, especially the central compartment, is technically demanding because of the presence of scar tissue and distorted anatomy, which may result in increased risk of injury to the recurrent laryngeal nerve and parathyroid glands [4, 5].

Various strategies have been developed to make the surgical excision of cervical recurrent lymph nodes easier, including the use of intraoperative US, wire-guided excision, or intraoperative ultrasound-guided dye injection [6–8]. We previously described the preoperative injection of a radiotracer under ultrasound guidance and radio-guided excision, which served to focus the dissection to the affected lymph nodes [9].

In the present study we aimed to investigate whether the radio-guided excision of metastatic lymph nodes allow to find the affected lymph nodes in patients with previously operated neck compartments.

Materials and methods

This prospective study included 46 patients with PTC previously operated neck compartments at the Department of General Surgery, Istanbul Medical Faculty, between September 2007 and December 2009. The diagnosis of recurrent/persistent PTC in the central or lateral neck was based on elevated basal or stimulated thyroglobulin (Tg) level, increased iodine uptake with whole body scintigraphy, or positron emission tomography (PET). We carried out PET to identify lymph node metastases in four patients who were Tg-positive and WBS-negative. For many years, the primary clinical application of PET scanning in thyroid cancer was to localize disease in Tg-positive, radioactive iodine (RAI) scan-negative patients. Metastatic cervical lymph nodes confirmed preoperatively by fine needle aspiration (FNA) cytology or FNA-Tg under ultrasound guidance (Table 1). The metastasis in neck level VI was referred to central metastasis, the metastasis in neck levels II thru V was referred to central metastasis.

Operations were performed by an experienced endocrine surgeon. There was continuous recurrent laryngeal nerve (RLN) monitoring throughout the operation for all patients (e.g., Medtronic NIM, Jacksonville, FL). In all patients, indirect laryngoscopic examination was performed to evaluate vocal cord motility before surgery and again one month after surgery. The presence of clinical symptoms or signs of hypocalcemia were noted. The study plan was reviewed and approved by the institutional ethical committee, and informed consent was obtained for all patients.

Radio-guided lymph node localization

Prior to operation, the patient's neck lesion was localized by US with a high frequency 10 MHz transducer. A 20-gauge needle was placed into the center of the suspicious lesion under US, and ^{99m}Tc-labeled rhenium colloid was injected directly into the pathologic node. The radiotracer was prepared before the (on the morning of the) procedure, and a single 0.2 ml aliquot was drawn into a syringe containing 20 MBq activity of ^{99m}Tc rhenium colloid as radiotracer. The injection of the radiotracer was performed by an experienced radiologist in the Radiology Department. Radiotracer was injected in to the all pathologic nodes when US indicated suspicious findings (i.e., axial diameter >6 mm, irregular borders, microcalcifications). The mean size of suspicious LN was 10.9 ± 5.2 mm (range: 3–24 mm).

This method was applied without concern for lymph node size, although lymph node size can be a relative contraindication for the procedure when location and mobility are taken into account. However, very small lymph nodes might not exhibit typical malignant sonographic characteristics, or those characteristics might be hard to detect, so detected nodes are generally big enough to be injected. If the lesion cannot be accessed due to vascular structures, the injection method generally is not employed because of the risk of hemorrhage or other complications. If it is absolutely necessary, however, vascular structures can be punctured followed by a firm compression to prevent hematoma formation. In the present study there were no cases in which the lymph node was confined to a vascular structure.

Radio-guided lymph node excision

An intraoperative hand-held gamma-probe (Navigator, Surgical γ-probe, Auto suture, France) was used to detect the tumor foci. In patients with central metastasis, an incision had been made via the previous neck incision. Then, superior and inferior subplatysmal flaps were created in a standard fashion, whereas in the patients with lateral metastasis, the neck was scanned with the probe to localize the area of maximal radioactivity allowing appropriate location of the incision over the lesion. The hot area was identified by a γ-probe, and the hot spot was shown to correspond to the area of maximum radioactivity. A mean count was calculated from measurements, with three counts for each region, and each count was recorded for 20 s. Careful dissection was carried out following the area of maximum radioactivity until the metastatic lymph node(s) were identified and excised. After the lymph nodes were removed, radioactivity was measured in the lesion bed to confirm the success of the dissection. The intraoperative

Table 1 Characteristics of the patients with recurrent thyroid cancer scheduled for radio-guided excision of metastatic lymph nodes

No.	Sex, age, type of carcinoma	Initial tumor state	Previous treatment	Time to recurrence (years)	Diagnosis of recurrence	Location of recurrence	Lymph node pathology	Follow-up
1	F, 53, PTC	T1 N0 M0	2000, TT, RAI	8	US, FNA-Tg, basal and stimulated Tg negative, anti-Tg positive	Left central	2/2	US negative, basal Tg negative
2	F, 42, PTC	T2 N0 M0	1998, TT, RAI	11	Basal Tg 3.2, US, FNA	Right central	1/3	US negative, basal Tg negative
3	F, 55, PTC	T1 N0 M0	2005, TT elsewhere	4	US, FNA-Tg, basal and stimulated Tg negative	Right central	1/5	US negative, basal Tg negative
4	F, 18, PTC	T2 N0 M0	2008, TT, RAI elsewhere	1	Basal Tg 4, PET, WBS, US, FNA-Tg	Right central	1/3	US negative, basal Tg 2.9
5	M, 31, PTC	T1 N0 M0	2002, TT, RAI	7	Basal Tg 5.5, US, FNA-Tg	Left central	2/2	US negative, basal Tg negative
6	F, 38, PTC	T1 N1a M0	2005, TT elsewhere; 2005, right CND + RAI	3	Basal Tg 16, US, FNA-Tg	Right central	1/1	Basal Tg negative, metastatic lmyph node in right central neck
7	M, 31, PTC	T1 N1a M0	2006, TT elsewhere; 2006, right CND + RAI	2	Basal Tg 11, US, FNA	Right central	2/2	Lost of follow-up
8	F, 56, PTC	T2 N0 M0	2007, TT + RAI elsewhere	2	Basal Tg 2.5, stimulated Tg 37, US, FNA	Left central	1/4	US negative, basal Tg negative
9	F, 40, PTC	T1 N0 M0	2004, TT elsewhere; 2006, right CND + RAI	5	Basal Tg 7.4, US, FNA-Tg	Right central	1/2	US negative, basal Tg 3
10	F, 55, PTC	T2 N1b M0	2006, TT + left CND + left LND + RAI	2	US, FNA-Tg, basal and stimulated Tg negative	Left lateral	1/1	US negative, basal Tg negative
11	F, 63, PTC	T1 N0 M0	2006, TT + RAI	2	US, FNA-Tg, basal and stimulated Tg negative	Left central	3/6	US negative, basal Tg negative
12	M, 42, PTC	T2 N1a M0	2007, TT elsewhere; 2007 right CND + RAI	2	Basal Tg 34, US, FNA-Tg	Right central	1/1	Basal Tg 14, metastatic lmyph node in right lateral neck
13	F, 17, PTC	T1 N0 M0	2006, TT + RAI	3	Basal Tg 3.5, PET, WBS, US, FNA	Right central	1/3	US negative, basal Tg negative
14	F, 41, PTC	T1 N0 M0	2002, TT + RAI	7	Basal Tg 4, US, FNA	Left central	2/4	US negative, basal Tg negative
15	F, 52, PTC	T1 N1a M0	2008, TT elsewhere; 2008 left CND + RAI	1	Basal Tg 3.2, US, FNA-Tg	Left central	1/2	US negative, basal Tg negative
16	F, 24, PTC	T3 N1a M0	2006, TT + right CND + RAI	2	Basal Tg 17, US, FNA-Tg	Right central	1/1	US negative, basal Tg 6.7, PET negative
17	F, 57, PTC	T2 N0 M0	2000, TT + RAI	7	US, FNA-Tg, basal and stimulated Tg negative	Right central	1/1	Lost of follow-up
18	F, 55, PTC	T1 N0 M0	2002, TT + RAI	6	Basal Tg 11, US, FNA-Tg	Left central	1/2	US negative, basal Tg 4
19	M, 59, PTC	T2 N0 M0	2000, TT + RAI	7	Basal Tg 1.2, stimulated Tg 15, US, FNA-Tg	Left central	2/4	US negative, basal Tg negative
20	F, 49, PTC	T1 N1a M0	2007, TT elsewhere; 2007, right CND + LND + RAI	2	Basal Tg 2.9, PET, WBS, US, FNA-Tg	Right lateral	1/1	US negative, basal Tg negative
21	F, 22, PTC	T3 N1a M0	2006, TT elsewhere; 2006, right CND + RAI	3	Basal Tg 4,5, US, FNA-Tg	Right central	1/1	US negative, basal Tg negative

Table 1 continued

No.	Sex, age, type of carcinoma	Initial tumor state	Previous treatment	Time to recurrence (years)	Diagnosis of recurrence	Location of recurrence	Lymph node pathology	Follow-up
22	F, 37, PTC	T3 N1b M0	2005, TT + right CND + right LND + RAI	2	US, FNA-Tg, basal and stimulated Tg negative	Right lateral	1/1	US negative, basal Tg negative
23	M, 51, PTC	T2 N0 M1	2002, TT + RAI elsewhere	7	Basal Tg 256, US, FNA	Left central	2/5	US negative, basal Tg 340, lung metastasis
24	F, 39, PTC	T1 N1a M0	2007, TT elsewhere; 2007, right CND + RAI	2	Basal Tg 2,9, US, FNA	Right central	1/1	US negative, basal Tg negative
25	F, 42, PTC	T2 N0 M0	1998, TT + RAI	10	Basal Tg 9.3, US, FNA-Tg	Right central	1/3	US negative, basal Tg 6, PET negative
26	F, 66, PTC	T1 N1b M0	2005, TT +left LND + RAI	4	Basal Tg 1.2, stimulated Tg 27, US, FNA-Tg	Left central	3/3	US negative, basal Tg negative
27	F, 47, PTC	T1 N0 M0	2000 TT	9	US, FNA-Tg, basal and stimulated Tg negative, anti-Tg positive	Right central	1/1	US negative, basal Tg negative
28	F, 55, PTC	T2 N1a M0	2005, right CND + RAI	3	Basal Tg 10, US, FNA	Right central	1/1	US negative, basal Tg 4
29	M, 45, PTC	T1 N1b M0	2006, TT + left LND + RAI elsewhere	3	Basal Tg 0.6, stimulated Tg 35, US, FNA-Tg	Left central	2/2	US negative, basal Tg negative
30	M, 24, PTC	T3 N1a M1	2004, TT + right LND + RAI	5	Basal Tg 87, US, FNA-Tg	Right central	1/1	US negative, basal Tg 290, lung metastasis
31	F, 51, PTC	T1 N0 M0	2000, TT + RAI	9	Basal Tg 3, stimulated Tg 47, US, FNA-Tg	Right central	2/5	US negative, basal Tg negative
32	F, 53, PTC	T1 N0 M0	1999, TT + RAI	10	Basal Tg 4.4, US, FNA	Left central	2/2	Lost of follow-up
33	F, 42, PTC	T1 N1a M0	2006, TT + right CND + RAI	2	US, FNA-Tg, basal and stimulated Tg negative	Right central	1/1	Metastatic lmyph node in right central neck, basal Tg negative
34	F, 55, PTC	T2 N0 M0	2002, TT + RAI elsewhere	6	Basal Tg 6.3, US, FNA-Tg	Right central	1/4	US negative, basal Tg 4, PET negative
35	F, 18, PTC	T2 N0 M0	2006, TT + RAI elsewhere	1	Basal Tg 4, PET, WBS, US, FNA-Tg	Left central	1/3	US negative, basal Tg negative
36	M, 31, PTC	T2 N1b M0	2006, TT elsewhere; 2006, right LND + RAI	1	Basal Tg 0.9, stimulated Tg 21, US, FNA-Tg	Right central	1/1	US negative, basal Tg negative
37	F, 38, PTC	T2 N0 M0	2003, TT elsewhere	4	Basal Tg 14, US, FNA-Tg	Right central	1/2	US negative, basal Tg 7
38	M, 31, PTC	T1 N0 M0	1997, TT + RAI	12	Basal Tg 3.4, stimulated Tg 54, US, FNA-Tg	Left central	2/3	US negative, basal Tg negative
39	F, 56, PTC	T2 N0 M0	2000, TT + RAI	8	Basal Tg 2, stimulated Tg 12, US, FNA-Tg,	Right central	2/4	Metastatic lmyph node in right lateral neck, basal Tg negative
40	F, 40, PTC	T1 N0 M0	2002, TT	5	Basal Tg 7.9, US, FNA-Tg	Left central	1/3	Lost of follow-up
41	F, 55, PTC	T2 N1a M0	2006, TT + RAI elsewhere; 2007 left CND	1	Basal Tg 4, US, FNA-Tg	Left central	1/1	US negative, basal Tg negative
42	F, 63, PTC	T3 N0 M0	1998 TT + RAI	9	Basal Tg 5.6, US, FNA-Tg	Right central	2/5	Metastatic lmyph node in right lateral neck, basal Tg 4
43	M, 42, PTC	T2 N1b M0	2006, TT elsewhere; 2006, right LND; 2007 right CND	2	Basal Tg 28, US, FNA-Tg	Right lateral	1/1	US negative, basal Tg negative

Table 1 continued

No.	Sex, age, type of carcinoma	Initial tumor state	Previous treatment	Time to recurrence (years)	Diagnosis of recurrence	Location of recurrence	Lymph node pathology	Follow-up
44	F, 17, PTC	T1 N0 M0	2000, TT + RAI	7	Basal Tg 2.5, stimulated Tg 14, US, FNA-Tg	Right central	2/3	US negative, basal Tg negative
45	F, 41, PTC	T2 N0 M0	2002, TT + RAI	6	Basal Tg 1.2, stimulated Tg 51, US, FNA	Left central	2/2	US negative, basal Tg negative
46	F, 52, PTC	T1 N1a M0	2005, TT + right CND + RAI	2	Basal Tg 1.5, stimulated Tg 28, US, FNA	Right central	1/1	US negative, basal Tg negative

F female, *M* male, *PTC* papillary thyroid cancer, *TT* total thyroidectomy, *CND* central neck dissection, *RAI* radioactive ablation, *LND* lateral neck dissection, *Tg* thyroglobulin, *PET* positron emission tomography, *WBS* whole body scan, *FNA* fine needle aspiration, *US* ultrasound

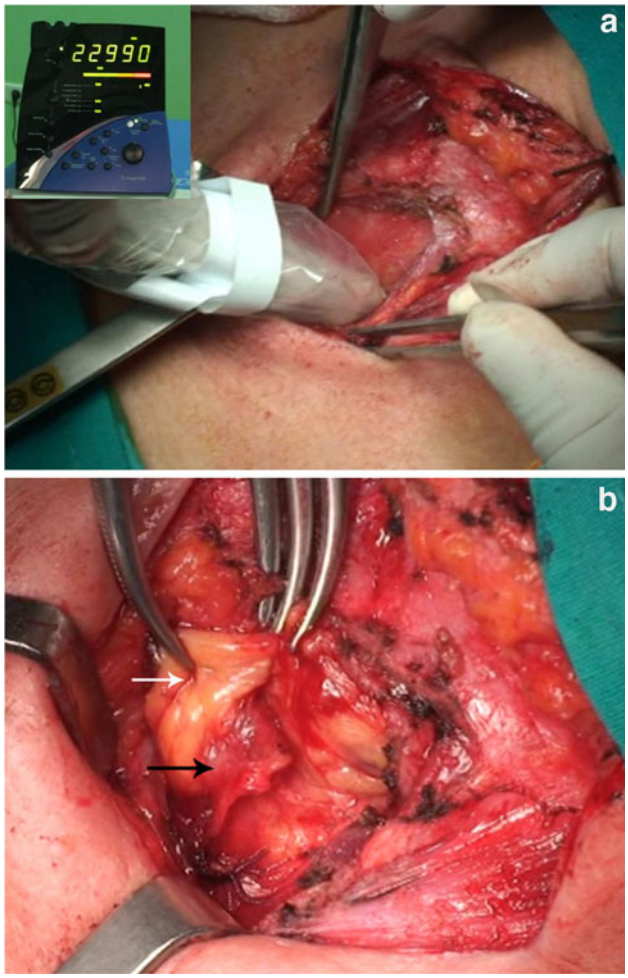

Fig. 1 **a** The area of maximum radioactivity. **b** Pathologic lymph node (*black arrow*), surrounding tissue (*white arrow*)

measurements of count rates were obtained from lymph node metastases, adjacent tissue, and background activity (Fig. 1).

Statistical analysis

Data are reported as the mean ± SD. Analysis was performed with the statistical package SPSS 10.1 (SPSS, Chicago, IL). Differences between parameters were compared with the Wilcoxon test. Results were considered statistically significant at $p < 0.05$.

Results

The mean age of the patients was 43.2 ± 13 years (range: 14–61 years). The female/male ratio was 3.6/1 ($n = 36/10$). The patients had a mean of 1.3 ± 0.5 prior neck operations. Of the 46 patients, 26 (56%) had undergone previous thyroidectomy, 20 (44%) had undergone previous

thyroidectomy and central or lateral neck dissection. The mean time from diagnosis of PTC to the radio-guided excision of metastatic lymph node(s) was 4.7 ± 3.1 years (range: 1–12 years) (Table 1).

In 43 patients, one lymph node was injected by radiotracer, whereas in 3 patients two pathologic lymph nodes were injected. In the central compartment, additional lymph nodes (not injected by radiotracer, pathologic or normal nodes) were removed in 63% of patients. All of the injected suspicious lymph nodes were detected in the area of maximum radioactivity. During operation, injected metastatic lymph node(s) and surrounding tissue were excised. In some cases, we observed a normal lymph node near the metastatic lymph node. We often removed injected metastatic lymph node(s) and surrounding tissue. At the histopathology examination, additional lymph nodes were detected. In 46 patients, 49 abnormal nodes were injected and 111 lymph nodes were removed. Of 111 removed nodes, 62 were additional (uninjected) lymph nodes. Of those 62 additional lymph nodes, 25 (40%) were metastatic.

One affected lymph node was removed in 17 patients, more than one lymph node (affected or additional nodes) were removed in 29 patients. A mean of 1.4 ± 0.5 pathologic nodes were removed, moreover, a mean of 1.3 ± 1.3 additional lymph nodes were removed. The median count from a lesion was significantly higher than the values measured from the lesion bed (background activity) (16,886 counts/20 s versus 52 counts/20 s; $p < 0.001$).

There were no complications related to the node injections. Three patients had preoperative unilateral vocal cord paralysis on the same side due to previously operations. Persistent vocal cord paralysis and hypoparathyroidism were not encountered in connection to the radio-guided excision of metastatic lymph nodes. The incidence of transient vocal cord paralysis and hypoparathyroidism was 4.3% (2/46) and 6.5% (3/46), respectively. Hypoparathyroidism improved with oral calcium and vitamin D supplementation with subsequent normal serum intact parathyroid hormone levels. Three patients who had transient vocal cord paralysis were improved 2 months after operation, and indirect laryngoscopy examination was normal.

During follow-up, four patients were lost to follow-up and 27 patients had negative US and basal Tg studies. Five patients had suspicious lymph nodes on the operated side. The mean size of the suspicious lymph nodes was 3.6 ± 0.8 mm (3–5 mm). We concluded that these nodes had not been detected by US before radio-guided excision. Although the basal Tg level remained above the normal limit, moderately high in 8 patients, no metastases were detected in the neck. However, the preoperative basal Tg levels of these patients (11.8 ± 8.7 mg/l) were higher than their postoperative Tg levels (5.5 ± 3.3 mg/l).

Discussion

Although papillary thyroid carcinoma is associated with an excellent prognosis; locoregional recurrence has been reported in up to 30% of patients. The routine use of thyroglobulin levels and neck ultrasound in the follow-up of patients with PTC has lead to an increase in the identification of pathological lymph nodes in the central or lateral neck [1, 2]. High-quality US is an established diagnostic tool for detecting metastatic lymph nodes as small as 2–3 mm in patients with thyroid cancer. The US features associated with the highest risk of cancer include heterogeneous echotexture, calcifications, and cystic areas within the lymph node [2, 3]. Fine needle aspiration (FNA) cytology and FNA-Tg measurement are the most efficient for detecting metastatic diseases in the neck [1, 2].

Lymph node metastases are a common finding with PTC, with an incidence as high as 50%. Many patients having clinically negative nodes on preoperative evaluation are found to have central lymph node metastases. Clinical examination may detect lymph node involvement in 15–30% of patients. However, data from centers where routine central lymph node dissection or sentinel lymph node biopsy are practiced show that occult metastases may be observed in up to 90% of patients [1, 2]. Historically, it has been widely accepted that the presence of central lymph node metastases is associated with increased locoregional recurrences. Historically, this association has been thought to have little effect on survival. At present, however, this opinion has begun to change. Several studies have shown that important predictors of poor outcome include the presence of lymph node metastases. Some centers advocate prophylactic central lymph node dissection [10, 11].

Local recurrence in PTC is usually seen in the central neck after the initial surgical treatment [1, 2]. For this reason, prophylactic central neck dissection is recommended by some groups. There are multiple conflicting studies in this area. For example, some studies show lymph node metastasis have no effect on recurrence or survival, whereas other studies demonstrate that nodal metastases are risk factors for increased disease-specific mortality, local recurrence, and distant metastatic spread [1, 10, 11]. However, some patients who are aware of their own metastasis can become anxious and will request removal of the recurrent tumor. We have accepted the concept that lymph node metastasis significantly impair quality of life and that surgical excision is the only effective curative treatment of local recurrences and over the last 2 years we have routinely performed prophylactic central lymph node dissection in patients with PTC (especially those with T3 or T4 tumors).

Alternatives to surgery for lymph node metastases include radiofrequency ablation (RFA), and alcohol injection [12, 13]. There are, however, some pitfalls associated with the use of these therapeutic tools. Ethanol can be extravasated from the lymph node, causing vocal cord paralysis. The use of RFA in the central neck may also lead to vocal cord injury.

Primary thyroidectomy is associated with a low incidence of recurrent laryngeal nerve injury and permanent hypoparathyroidism when performed by an experienced surgeon. However, the incidence of permanent recurrent laryngeal nerve paralysis for reoperative thyroid surgery is higher, ranging from 1 to 12% [14, 15].

Reoperative thyroid surgery is technically more demanding because of the presence of scar tissue and disturbance of the normal anatomic relationships [4, 5]. The surgeon may encounter significant difficulty in the identification and preservation of the recurrent laryngeal nerves and parathyroid glands, and this may increase the risk of postoperative complications. Reoperations in the cervical compartment are difficult, especially when the tumor foci are localized within extensive scarring; therefore various methods have been developed to detect the recurrent disease [4, 5].

A recent publication reports US-guided hook-needle insertion into metastatic lymph nodes in order to facilitate intraoperative identification of recurrences [7]. The wire-guided localization (WGL) technique has become a standard for occult breast lesions. Several problems with WGL have been reported, such as difficult wire placement in dense breasts; difficulties in re-positioning; dislodgement; transaction; wire loss during surgery; and patient discomfort [16]. These difficulties are encountered more often in connection with neck metastasis. Similarly, authors describing US-guided hook-needle insertion into metastatic lymph nodes cite: difficulty in some patients as the needle became dislodged during retraction, raising concern over the accuracy of this localization technique [8]. The same authors also defined a technique of intraoperative US-guided dye injection into the metastatic lymph nodes, thus facilitating their identification. It can be difficult to recognize metastases in lymph nodes with extensive scarring that are marked with blue dye. With the blue dye technique, it is necessary to dissect the scarred field in order to visualize the lymph nodes marked with blue dye. The injected node is usually dark blue in color, but because of the dense scar tissue, the lymph node usually cannot be visualized until the scar tissue is removed. Gaining access to the lymph node requires a difficult dissection. Use of a γ-probe guided us to find the relevant area. Away from relevant area, the gamma count decreased, making it possible to target and remove the affected lymph nodes in the scar tissue safely and easily. This technique also involves use of US.

We previously described a series in which preoperative ultrasound was used to inject radioactive material directly into the affected lymph nodes [9]. It is known that non-palpable breast lesions have been localized using the technique of radio-guided occult lesion localization (ROLL) [16]. Technetium 99 m was injected directly into the center of the suspicious lesion under US. The dissection was carried out following the area of maximum radioactivity until the metastatic lymph nodes were identified and excised. The risk of radiation to the patient and the surgeon is negligible with intraoperative administration of 0.5 mCi ^{99m}Tc. Because radiotracer is injected directly into the lesion, tumor foci are easily identified independent from tumor's capability of trapping radiotracer.

The most difficult part of reoperation in cervical compartment is to determine the location of lesions embedded in scar tissue. In the technique described here, our aim was to determination the area of maximal radioactivity and establish the easiest and safest route for dissection. Involving the nuclear medicine and radiology departments could seem to be a disadvantage. However, these patients should be treated in tertiary referral centers and operated by experienced endocrine surgeons.

In conclusion, radio-guided excision of metastatic lymph nodes can be performed safely for the detection and excision of recurrent thyroid cancer in the central and lateral neck.

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