

Roles of ultrasonography and computed tomography in the surgical management of cervical lymph node metastases in papillary thyroid carcinoma

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Abstract

Aims: Adequate evaluation and surgical management of cervical lymph node metastasis is very important in papillary thyroid carcinoma (PTC). The aim of this study was to evaluate the impact of preoperative ultrasonography (US) and computed tomography (CT) on the surgical management of cervical lymph node metastases in PTC.

Methods: Medical records and imaging findings were retrospectively analyzed for 252 patients with PTC who underwent thyroidectomy with neck dissection.

Results: The sensitivity of both imaging techniques was lower in the central neck (US 23%, CT 41%) than in the lateral neck (US 70%, CT 82%). The specificities of US and CT were 97% and 90% in the central neck, and 84% and 64% in the lateral neck, respectively. Our surgical plans for therapeutic neck dissection were based on imaging findings in 59% of patients who underwent lateral compartment neck dissection and in 32.1% of patients who underwent central compartment neck dissection, respectively.

Conclusions: The roles of preoperative US and CT in surgical planning for central compartment neck dissection in PTC are limited because of their low sensitivity in the central neck, but US and CT may be useful in cases with non-palpable lateral neck nodes.

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Introduction

Papillary thyroid carcinoma (PTC) characteristically spreads early to regional lymph nodes, but rarely causes distant metastases.^{1,2} PTC involves metastasis to cervical lymph nodes in 30–80% of patients,^{2,3} and recent studies have revealed that regional lymph node metastasis has an adverse prognostic impact on survival, especially in older patients (≥ 45 years).^{4,5} PTC recur most frequently at the cervical lymph nodes; loco-regional recurrences are reported in up to 31% of patients.^{6–8} Such high rates of recurrence suggest that many patients have lymph node metastases at the time of initial surgery, and that if these metastases can be detected and removed, future cervical recurrence and patient morbidity will be reduced.⁹

The indications for, and extent of, lymph node dissection are the most contested issues in the surgical management of PTC. Therapeutic central or lateral compartment neck dissection should be performed for patients who have PTC with clinically apparent cervical lymph node metastasis detected by palpation or imaging studies.^{10,11} Prophylactic central compartment neck dissection (CCND) may be performed in patients with PTC, especially for advanced T3 and T4 tumors, while prophylactic lateral compartment neck dissection (LCND) is not generally recommended, according to the American Thyroid Association (ATA) guidelines.¹² Because neck dissection can result in postoperative complications such as hypocalcemia, recurrent laryngeal nerve palsy, hematoma, chyle leakage, and spinal accessory nerve dysfunction, the indications for neck dissection should be carefully investigated.^{12,13}

Therefore, in order to make treatment decisions regarding neck dissection, it is very important that clinicians evaluate cervical lymph node metastasis adequately. Lymph

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node metastasis may be preoperatively evaluated by palpation or imaging tests including ultrasonography (US), computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography (PET). Although US is the most routinely recommended of these imaging methods for primary preoperative evaluation of lymph node metastases in patients with PTC,¹² CT is also very useful in practice. There have been several studies exploring the features and diagnostic value of US and CT,^{14–16} but there are only a few studies which compare the utility of physical examination, US, and CT in determining the surgical plan for neck dissection from the surgeon's point of view. Therefore, the aim of this study was to compare the accuracy of physical examination, US, and CT in the preoperative detection of cervical lymph node metastasis and to evaluate how these methods influence the surgical management of the neck in patients with PTC.

Patients and methods

Patients

We retrospectively reviewed medical records and imaging findings for 252 patients with PTC who underwent thyroidectomy and CCND with/without LCND from January 2007 to May 2010. This study was approved by the Institutional Review Board of Hanyang University Hospital. The diagnosis of PTC was confirmed pathologically for all patients after thyroidectomy. The characteristics of patients and tumors are summarized in Table 1. The patient group included 207 females and 45 males, and the median age was 49 years (range 15–82 years). The T classification

(American Joint Committee on Cancer, 6th edition) was T1 in 123 cases, T2 in 13 cases, T3 in 115 cases and T4 in 1 case.

Physical examination, and US and CT evaluation

Preoperative physical examination, US, and CT were performed for evaluation of cervical lymph node metastasis in all patients, and US-guided fine needle aspiration cytology (FNAC) for lateral compartment lymph nodes was performed in some of the patients who had positive imaging findings in the lateral neck. The number, location, size, texture, and fixation of lymph nodes were investigated by palpation. Lymph nodes that were hard, fixed, and greater than 1 cm (1.5 cm in level II) in diameter were accepted as evidence of metastasis on palpation.

The levels of cervical lymph nodes including levels I–VI were classified according to image-based nodal classification on the right and left sides, and level VI nodes were also divided into right and left sides.¹⁷ The neck levels were divided into 3 groups: total neck (levels I–VI), central neck (level VI), and lateral neck (levels I, II, III, IV, V).

The criteria for identifying metastases in US images were as follows: round shape (long/short diameter ratio <2), calcification (microcalcification), cystic change, hyperechogenicity, and heterogeneous inner structure.^{14,15,18} The criteria for CT images were as follows: enhancement, heterogeneity, calcification, cystic or necrotic change, and round shape. As for size, it is difficult to set the cutoff values for metastatic nodes in PTC. We defined the size criteria for metastases in both US and CT images as follows: a nodal diameter of >15 mm for the long axes of the jugulodiagastric and submandibular nodes and >10 mm for all other cervical nodes, except for level VI.¹⁹ We did not apply size criteria for lymph node metastases in level VI.

All US examinations were performed by an expert radiologist. We also assessed the radiologists' interpretations of US and CT images and compared them with the final pathology reports. The diagnostic values of US and CT were defined as sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of the evaluation for lymph node metastasis. We compared the diagnostic values of US, CT and the combination of US and CT (US + CT). We analyzed the diagnostic values in each central, lateral, and total neck on a per level and per patient basis. The presence or absence of lymph node metastasis as determined by physical examination, US, or CT, was recorded as positive or negative.

Statistical analysis

The McNemar test was used to determine whether the sensitivities and specificities of US, CT, and US + CT differed significantly.²⁰ All analyses were performed using

Table 1
Patient demographics and tumor characteristics ($n = 252$).

		Number of patients	%
Gender	Male	45	17.9
	Female	207	82.1
Age	≤45	97	38.5
	>45	155	61.5
	Median (range)	49 (15–82)	
Primary tumor	Size (median, range)	10 mm (3–60)	
	Multifocal	74	21.0
	Bilateral	60	17.0
	Extrathyroidal extension (minimal)	114	32.4
T classification	T1	123	48.8
	T2	13	5.2
	T3	115	45.6
	T4	1	0.4
N classification	N0	131	52.0
	N1a	90	35.7
	N1b	31	12.3
M classification	M1	1	
TNM stage	STAGE I	139	55.2
	STAGE II	5	2.0
	STAGE III	92	36.5
	STAGE IVA	16	6.3

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