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# The role of lateral neck ultrasound in detecting single or multiple lymph nodes in papillary thyroid cancer



Zahraa Al-Hilli, M.D., Veljko Strajina, M.D., Travis J. McKenzie, M.D.,  
Geoffrey B. Thompson, M.D., David R. Farley, M.D.,  
Melanie L. Richards, M.D.\*

Department of Surgery, Mayo Clinic, 200 First Street SW, Rochester, MN 55905, USA

## KEYWORDS:

Papillary thyroid cancer;  
Neck ultrasound;  
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## Abstract

**BACKGROUND:** Lateral neck dissection (LND) for papillary thyroid cancer (PTC) transitioned from isolated lymphadenectomy or “berry picking” based on clinical examination to multicompartment lymphadenectomy. We aimed to assess ultrasound (US) as a predictor of solitary (SLN) or multiple lymph node (MLN) metastases.

**METHODS:** Demographics, US findings, extent of LND, and pathology were collected in patients with PTC who underwent LND. US sensitivity and specificity were calculated, and accuracy was correlated with US findings and patient characteristics.

**RESULTS:** A total of 462 patients underwent 590 LNDs. US showed an SLN in 179 patients (30%) and MLNs in 411 patients (70%). Sensitivity, positive predictive value, and accuracy were 61%, 43%, and 75% for US detected SLN and 78%, 89%, and 75% for US detected MLNs. US accuracy for MLNs increased as node size increased (<10 mm, 63%; 10 to 20 mm, 71%; >20 mm, 89%;  $P < .0001$ ).

**CONCLUSIONS:** US has limited accuracy in the detection SLN metastasis in the lateral neck. Care should be taken when considering a focused compartment dissection.

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Papillary thyroid carcinoma (PTC) is the most common thyroid malignancy, accounting for 86% of all thyroid cancers.<sup>1</sup> A recent report based on the Surveillance, Epidemiology and End Results database from 1975 to 2000, demonstrated a tripling in the incidence of thyroid cancer

from 4.9 to 14.3 per 100,000 individuals, with virtually the entire increase attributed to papillary thyroid cancer (increase from 3.4 to 12.5 per 100,000 individuals).<sup>2</sup> During this time, the mortality rate from thyroid cancer was stable accounting for approximately .5 deaths per 100,000. Despite having a favorable prognosis, PTC is frequently associated with cervical lymph node metastasis with rates ranging from 20% to 90%.<sup>3-10</sup> Furthermore, lymph node metastases are the most common independent risk factor for disease persistence, recurrence, and mortality.<sup>11-14</sup>

A therapeutic lymphadenectomy is indicated and is the mainstay treatment for clinically evident cervical lymph node metastases. Cervical lymph node dissection has ranged from a “berry-picking” approach or selective nodal

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\* Corresponding author: Tel.: +1 (507) 284-3975; fax: +1 (507) 284-5196.

E-mail address: [Richards.melanie@mayo.edu](mailto:Richards.melanie@mayo.edu)

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excision in which only grossly involved lymph nodes are excised, to a formal modified radical neck dissection which involves removing levels II to V. A berry-picking approach has been abandoned due to its associated high risk of recurrence in the neck and therefore is primarily limited to regional recurrence following a prior anatomic dissection. A more common and contemporary approach is to perform a selective lymph node dissection, in which a formal compartment-oriented approach is used where one or more lymph node levels are preserved.

The 2015 American Thyroid Association (ATA) guidelines recommend performing a “preoperative neck ultrasound (US) for cervical (central and especially lateral neck compartment) lymph nodes for all patients undergoing thyroidectomy for malignant or suspicious for malignancy cytologic or molecular findings.”<sup>15</sup> Features suggestive of abnormal metastatic lymph nodes include enlargement, loss of fatty hilum, a rounded rather than oval shape, hyperechogenicity, cystic change, calcifications, and peripheral vascularity.<sup>15</sup> The sensitivity and specificity of US in the detection of lymph node metastasis are variable. However, the sensitivity of US improves with operator experience and advanced technology.<sup>16</sup> The purpose of this study was to determine if US is an accurate predictor of pathologically confirmed solitary (SLN) or multiple lymph node (MLN) metastases to the lateral neck in PTC.

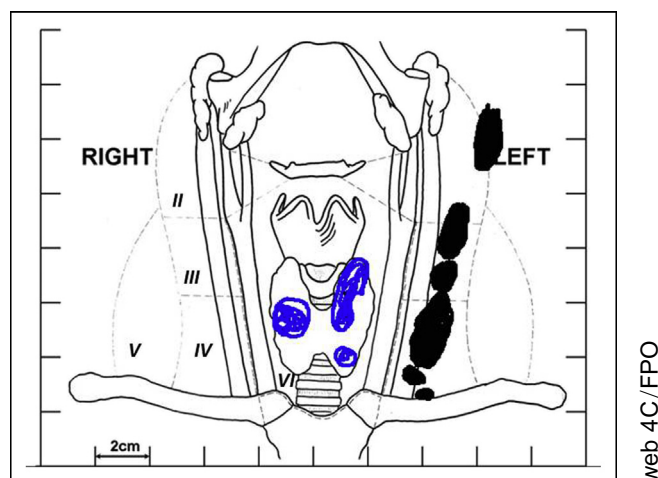
## Methods

### Study population

After institutional review board approval, patients undergoing a lateral neck dissection (LND) for papillary thyroid carcinoma between January 2000 and July 2015 were identified using institutional pathology and surgical records. Patients who underwent multiple procedures were included as a unique record for each procedure performed. Patients who did not have a neck US and those with nonpapillary thyroid carcinoma were excluded. Data were extracted by reviewing patient medical records and included details of patient demographics and characteristics (age, gender, and body mass index), preoperative investigations, and results (US findings, fine-needle aspiration, and thyroglobulin assay results), extent of lymphadenectomy, and final lymph node pathology. A modified radical neck dissection included levels II to V, a selective neck dissection included levels II, IV, and anterior Vb, while a focused neck dissection included a single compartment or berry picking.

### Ultrasound

All patients underwent a preoperative neck US with a high-resolution US equipped with high-frequency linear-array transducers of 7 to 13 MHz. US of cervical lymph nodes for survey of neck lymph nodes in patients with PTC



**Figure 1** Example of an US map prepared by the imaging radiologist. Abnormalities within the thyroid and abnormal lymph nodes are mapped on the image. Blue markings showing abnormalities within the thyroid, and black markings showing suspicious lymph nodes. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

was performed by the radiology department at our institution. US features suggestive of metastatic lymph nodes included a microcalcification, cystic changes, peripheral vascular flow on color Doppler imaging, hyperechogenicity, and a rounded shape (long axis to short axis ratio of  $<1.5$ ). Lymph nodes noted on imaging were classified as benign, indeterminate, suspicious, or malignant. The findings of indeterminate, suspicious, or malignant features were considered abnormal. US was used to derive a map that in one unified view identified the location of metastatic lymph nodes within various neck compartments (Fig. 1). Neck lymph node compartments were defined according to the 2009 classification by the American Head and Neck Society and the Committee for Head and Neck Surgery and Oncology of the American Academy of Otolaryngology–Head and Neck Surgery.<sup>17</sup> Extent of surgical excision was determined before operation. An US is not routinely repeated in the operating room unless there is uncertainty about the location of an abnormal lymph node, specifically in the setting of recurrent disease and reoperation.

### Statistical analysis

Descriptive statistics are reported as frequencies (percentage) for discrete variables and as mean (standard deviation [SD]) or median (range) as appropriate for continuous variables. Sensitivity, specificity, positive predictive value (PPV), negative predictive value, and accuracy of US in detecting a single lymph node (compared with MLNs) were estimated considering the pathology result as the true status for the number of nodes ( $=1$  vs  $>1$ ). Patient, imaging, and lymph node characteristics were

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