The Role of Sonography in Thyroid Cancer

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KEYWORDS

• Thyroid nodules • Thyroid cancer • Fine-needle aspiration biopsy
• Cervical lymph node metastases • Lateral neck compartment • Central neck compartment

KEY POINTS

- Thyroid nodules are commonly detected on ultrasound (US).
- Specific sonographic features are found in many malignant nodules and lymph nodes.
- Identification of cervical nodal metastasis is important for accurate staging and surgical management of de novo thyroid cancer.
- Pathologic diagnosis of a thyroid nodule requires fine-needle aspiration (FNA).
- US accurately provides imaging guidance for FNA of indeterminate or suspicious thyroid nodules and cervical lymph nodes.
- US is routinely used in the postoperative surveillance of the neck for tumor recurrence in the thyroid bed or nodal stations.

INTRODUCTION

According to the National Cancer Institute, an estimated 63,000 cases of thyroid cancer will be diagnosed in 2014.[1] When pathologically well differentiated and diagnosed early, the disease is highly treatable and can be curable. The 5-year relative survival rate of most types of stage I thyroid cancer approaches 100%.[2]

US is used routinely in the diagnosis and management of thyroid cancer, from initial detection and diagnosis to preoperative planning to postoperative surveillance. This review discusses the various roles of sonography in managing patients with thyroid cancer and reviews the sonographic appearance of thyroid cancer and nodal metastases.

NORMAL ANATOMY AND IMAGING TECHNIQUE

The thyroid gland is a bilobed gland that sits atop the trachea within the anterior-inferior neck (**Fig. 1**). The isthmus connects the right and left thyroid lobes. Each lobe measures approximately 4 to 6 cm in length and less than 2 cm in width and in the anterior-posterior dimension.[3] The normal isthmus measures less than 6 mm in the anterior-posterior dimension. The normal gland is homogeneous in echotexture and hyperechoic compared with the adjacent strap muscles (see **Fig. 1**).

After documentation of any thyroid lesion that has suspicious features for primary thyroid cancer, the cervical lymph nodes are imaged. A normal lymph node has an elongated shape (a 2:1 ratio between length and short-axis dimensions) and demonstrates an echogenic fatty hilum. Vascular flow is seen entering into the lymph node via the fatty hilum (**Fig. 2**) and the cortex is symmetrically hypoechoic.

The neck can be divided into nodal levels or stations by anatomic landmarks. The numeric classification system of the neck nodal stations is outlined in **Table 1** and depicted in **Fig. 3**.[4] Using this classification, the neck can be divided into

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Radiol Clin N Am 52 (2014) 1283–1294
http://dx.doi.org/10.1016/j.rcl.2014.07.007

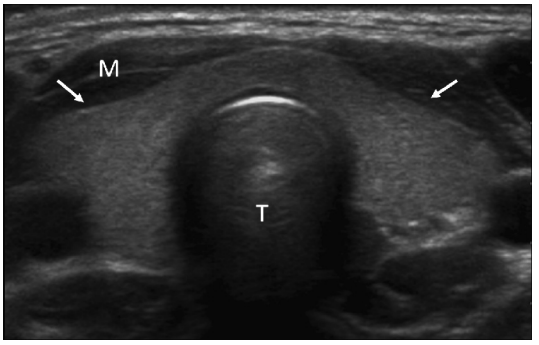

Fig. 1. Normal sonographic appearance of the thyroid. The thyroid (*arrows*) sits atop the trachea (T) and is a bilobed structure echogenic to the adjacent musculature (M).

central and lateral neck compartments. Stations I, VI, and VII are considered central neck compartments and stations II to V are considered lateral neck compartments. The medial edge of the common carotid artery serves as a landmark to divide the central from the lateral compartment. The distinction between the central and lateral neck compartments is important for the surgical management of thyroid cancer if nodal metastases are present (discussed later).

IMAGING PROTOCOLS

Thyroid

The thyroid gland is imaged with a linear high-frequency transducer (7–15 MHz). Occasionally, if the thyroid gland is enlarged, a curved, lower-frequency transducer may be used to fully image the thyroid.

The right and left thyroid lobes are imaged in the transverse and sagittal planes. Anterior-posterior dimension, width, and length are measured at the mid thyroid gland. The isthmus is measured in the anterior-posterior dimension. Nodules, if present, are measured in the transverse and sagittal planes in three dimensions and evaluated with color Doppler to document vascularity.

Cervical Lymph Nodes

The neck nodes are imaged with the same transducers as the thyroid: a high-frequency linear transducer for most of the nodal stations and occasionally a curved transducer for the lower and, therefore, deeper level IV and VI lymph nodes.

Each nodal station within the neck is evaluated to assess for the presence of normal or abnormal lymph nodes. Normal-appearing lymph nodes can be documented for each level, with the fatty hilum included in the image. Measurement of sonographically normal-appearing lymph nodes is not necessary. Abnormal lymph nodes (discussed later) should be imaged and measured in the transverse and sagittal planes. The nodes also should be interrogated with color Doppler US to assess for abnormal and disorganized blood flow.

General imaging protocols for the thyroid gland and cervical lymph nodes are summarized in **Table 2**.

IMAGING FINDINGS AND PATHOLOGY

Types of Thyroid Cancer

There are several types of primary thyroid cancer. Papillary thyroid carcinoma (PTC) is the most common, accounting for approximately 75% to 80% of thyroid cancers. PTC is multifocal in approximately 20% of cases and more common in females than males. PTC usually presents before age 40 years, often with cervical nodal metastases. It is also the most common thyroid malignancy in children. PTC has the best prognosis and highest survival rate of all thyroid cancers, reaching a 20-year survival rate of approximately 90% to 95%. Other types of thyroid carcinoma include follicular carcinoma (10%–20%), medullary carcinoma (5%–10%), and anaplastic carcinoma

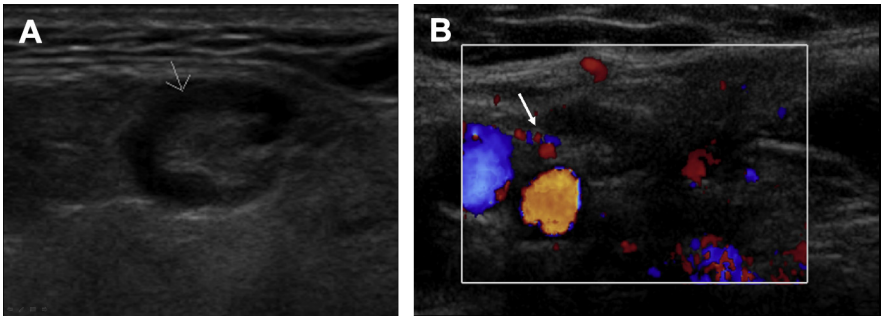

Fig. 2. Normal lymph nodes. (*A*) Lymph node with smooth, homogeneous, hypoechoic cortex (*arrow*), and central echogenic fatty hilum. (*B*) Another lymph node demonstrating normal central hilar flow (*arrow*).