AIUM Practice Parameter for the Performance of

Ultrasound Examinations of the Head and Neck

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The American Institute of Ultrasound in Medicine (AIUM) is a multidisciplinary association dedicated to advancing the safe and effective use of ultrasound in medicine through professional and public education, research, development of parameters, and accreditation. To promote this mission, the AIUM is pleased to publish, in conjunction with the American Academy of Otolaryngology–Head and Neck Surgery, this revised *AIUM Practice Parameter for the Performance of Ultrasound Examinations of the Head and Neck*. We are indebted to the many volunteers who contributed their time, knowledge, and energy to bringing this document to completion.

The AIUM represents the entire range of clinical and basic science interests in medical diagnostic ultrasound, and, with hundreds of volunteers, the AIUM has promoted the safe and effective use of ultrasound in clinical medicine for more than 50 years. This document and others like it will continue to advance this mission.

Practice parameters of the AIUM are intended to provide the medical ultrasound community with parameters for the performance and recording of high-quality ultrasound examinations. The parameters reflect what the AIUM considers the minimum criteria for a complete examination in each area but are not intended to establish a legal standard of care. AIUM-accredited practices are expected to generally follow the parameters with recognition that deviations from these parameters will be needed in some cases, depending on patient needs and available equipment. Practices are encouraged to go beyond the parameters to provide additional service and information as needed.

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I. Introduction

The clinical aspects of this parameter (Indications, Specifications of the Examination, and Equipment Specifications) have been developed collaboratively by the AIUM and the American Academy of Otolaryngology–Head and Neck Surgery (AAO-HNS). In addition, recommendations from the American College of Radiology (ACR) and the American Association of Clinical Endocrinologists (AACE) have been incorporated into selective areas of this management parameter for head and neck ultrasound. Several sections of this parameter (Qualifications and Responsibilities of Personnel, Documentation, and Quality Control and Improvement, Safety, Infection Control, and Patient Education Concerns) vary between the organizations and are addressed by each separately. This parameter has been developed to assist practitioners performing an ultrasound examination in the practice of head and neck surgery. While it is not possible to detect every abnormality, adherence to the following parameters will maximize the probability of answering the clinical question prompting the study.

II. Qualifications and Responsibilities of Personnel

See the AIUM Official Statement *Training Guidelines for Physicians Who Evaluate and Interpret Ultrasound Examinations of the Head and Neck* and the AIUM *Standards and Guidelines for the Accreditation of Ultrasound Practices.*

III. Written Request for the Examination

The written or electronic request for an ultrasound examination should provide sufficient information to allow for the appropriate performance and interpretation of the examination. The request for the examination must be originated by a physician or other appropriately licensed health care provider or under the provider's direction. The accompanying clinical information should be provided by a physician or other appropriate health care provider familiar with the patient's clinical situation and should be consistent with relevant legal and local health care facility requirements.

IV. General Specifications

The head and neck constitute a broad anatomic region, which encompasses many aerodigestive, salivary gland, lymphatic, endocrine, nervous, and vascular structures. A substantial number of the pathologic conditions affecting these organ systems are accessible to ultrasound imaging. In combination with needle aspiration for cytology, culture, hormone assay, core biopsy, and molecular markers, high-frequency ultrasound is an indispensable tool for the clinician who works in this clinical arena.

The examination should be performed with the patient in the sitting or supine position and the neck in extension. A systematic examination should be completed according to the preference of the physician performing the ultrasound procedure as long as it is standardized and thorough. For a right-handed examiner, the console should be located next to the patient's right shoulder. If a focal lesion is identified on physical examination, the ultrasound procedure may concentrate on that area. However, in every circumstance, a basic thyroid assessment and examination of the neck should be performed, as this is a unique opportunity to detect occult pathology with a simple screening evaluation.

The indications and specifications for head and neck ultrasound examinations have been grouped as follows:

A. Salivary glands;

B. Lymph nodes;

C. Congenital lesions;

D. Miscellaneous mass lesions;

E. Infection and trauma; and

F. Endocrine.

The conditions listed within these categories represent some but not all of those encountered by the clinician who works in this area.

V. Specifications for Individual Examinations

A. Salivary Glands (Sublingual, Submandibular, and Parotid)

1. Indications for a salivary gland ultrasound examination include but are not limited to the following:
   - Diffuse enlargement and tenderness consistent with inflammatory sialadenitis[1–4];
   - Suspected abscess formation;
   - Recurrent swelling suggesting Sjogren's disorder[5,6];
   - Swelling with alimentation, suggestive of obstructing calculus;
   - Discrete solitary mass suggestive of a benign or malignant neoplasm[7–9];
   - Multiple masses, possibly consistent with cysts suggesting human immunodeficiency virus[10–12]; and
   - Anterior floor-of-the-mouth lesion, which may be solid or cystic, the latter suggestive of a simple or plunging ranula.

Salivary glands should be systematically evaluated in transverse, anteroposterior, and longitudinal planes, noting parenchymal echogenicity and the presence of focal abnormalities. Each salivary gland examined should be compared with the asymptomatic contralateral gland.[13–15]

The normal echogenicity of all major salivary glands is typically homogeneous and varies from relatively bright and hyperechoic to only "slightly" hyperechoic compared to the adjacent musculature of the neck. The variation in echogenicity is caused by varying amounts of intraglandular fat, which appears bright on sonography and also suppresses transmission of sound into the deeper portion of the glands. In some patients, the gland may be so fatty as to only allow interrogation of the superficial aspect of the gland, thereby limiting the diagnostic value of sonography in these special circumstances.

The submandibular gland is seen inferior to the body of the mandible and is framed by the digastric muscle bellies. Submandibular glands are posterolaterally positioned just deep to the mylohyoid. It is usually possible to identify the portion of the submandibular gland that extends deep to the mylohyoid.

The parotid gland's superficial lobe overlies the masseter muscle, and its "tail" extends posterior to the angle of the mandible. The deep lobe extends deep to the plane of the mandible, and its full dimension is lost from view in the parapharyngeal space.

B. Lymph Nodes

1. Indications for an ultrasound examination of enlarged cervical lymph nodes include but are not limited to the following:
   - Determination of likely inflammation from metastatic malignant lymph nodes[16–19];
   - Determination of a lymph node from another mass lesion such as a cyst, schwannoma, paraganglioma, lipoma, or parathyroid adenoma;
   - Determination of possible lymphomatous node(s)[20–22];
   - Determination of the presence of metastatic lymphadenopathy at specific levels to determine the required type of neck dissection[23–25];
   - Determination of the specific level of metastatic squamous cell carcinoma within lymph node(s) to assist in defining the primary source[26];
   - Fine-needle aspiration (FNA) for cytology[27–29]; and
   - Core sampling for lymphoma.[30]

A mass identified on physical examination is well suited to subsequent sonographic evaluation. The examination may be tailored to investigate a single palpable lesion but often will involve a more thorough and comprehensive evaluation of several node basins. Lymph nodes are examined initially with grayscale ultrasound imaging. If a focused examination is performed, a regional or comprehensive ultrasound inspection of other lymph node levels is usually required. If a primary malignant lesion in the aerodigestive tract or thyroid gland is identified on physical examination, ultrasound may be the first-line imaging modality used. It will allow the clinician to identify other nodes that may not be palpable and access to cytology with ultrasound-guided FNA.

A comprehensive survey of the neck with ultrasound is usually performed with the transducer positioned in the transverse plane and the head rotated to the side opposite the area under study. The patient may be supine or semirecumbent with the neck in extension. Defined levels of the neck are illustrated in Figure 1. One standardized technique is to proceed through the submental and submandibular, parotid, and jugulodigastric regions (levels I and II) and then descend along the carotid and internal jugular vessels to the clavicle, thus completing inspection of levels III and IV. During this process, the transducer is posteriorly skewed such that a concurrent examination of the anterior portion of the posterior triangle (level V) is accomplished. The lower aspect of level V is then examined as the transducer passes along the superior aspect of the clavicle to the trapezius muscle. From this point, the posterior aspect of level V is examined as the transducer passes superiorly along the trapezius to the mastoid tip. Finally, level VI is examined as a midline region from the hyoid bone to the manubrium with the head rotated back to a neutral position. If the primary lesion warrants, the transducer can be angled inferiorly and the depth adjusted to allow examination of the anterior mediastinum on either or both sides. Any suspicious lymph nodes along this schematic path can be addressed as individual entities with consideration of the following characteristics: size, shape, solitary versus multiple, echogenicity, presence or absence of a hilar line, and character of its margin with surrounding tissues. The specific level of node enlargement should be defined. The transverse, anteroposterior, and longitudinal dimensions are then recorded. Specific details such as the presence of macrocalcifications and microcalcifications, colloid, cyst formation, and other unique findings should be described. Last, power Doppler imaging is applied to the enlarged node to determine the pattern of its microvascularity.

A complete sonographic survey of the neck is recorded in the following sequence: The upper neck (levels I and II) can be documented in 2 transverse grayscale images, which would also show the parotid gland. The mid neck and thyroid gland can be shown in 2 transverse grayscale images of levels III, IV, and VI. The posterior triangle can be shown in 2 or 3 transverse grayscale images along the supraclavicular region and middle aspect of level V. Cine loops of these regions are suitable alternatives to static images.

No single sonographic characteristic defines nodal malignancy, and there is often overlap in the appearance of benign and malignant lymph nodes. Rather, there are multiple features that must be considered in a composite sense to determine whether nodes are malignant or inflammatory. Features concerning for malignancy include cystic degeneration of all or part of the node, large dimensions, a rounded appearance with nearly equal transverse, anteroposterior, and longitudinal measurements, microcalcifications, irregular margins, cortical thickening, and peripheral or transnodal vascularity on power Doppler imaging. Inflammatory nodes may be quite large but retain their fatty hilum and associated axial vascularity on Doppler imaging.[31,32]

C. Congenital Lesions

1. Indications for an ultrasound examination of a mass in the pediatric neck include but are not limited to the following:
   - Localization of lymphangioma[33,34];
   - Localization of hemangioma[33,34];
   - Localization of a parotid cyst[33,34];
   - Localization of a branchial cleft cyst[35];
   - Localization of a thyroglossal duct cyst[36–38];
   - Localization of parathyroid and thymic cysts[33–35]; and
   - Indirect determination of an undescended thyroid gland.[39]

Congenital lesions are usually first noted during childhood, and ultrasound is the ideal initial, and frequently only required, imaging modality. The absence of radiation exposure and rapidity of the examination make it especially suitable for children. Its only limitation in children is the required brevity of the examination and frequent agitation, which can produce noise artifacts. Lesions of interest should be identified and measured in 3 dimensions, and Doppler imaging is often used.

D. Neurovascular and Miscellaneous Mass Lesions

1. Indications for an ultrasound evaluation of neural-derived and other lesions of the neck as well as vascular abnormalities include but are not limited to the following:
   - Identification of paraganglioma of the carotid bifurcation (carotid body tumor)[40,41];
   - Identification of paraganglioma, schwannoma, lymphoma, or pleomorphic adenoma of the parapharyngeal space[42,43];
   - Identification of internal jugular vein thrombosis;
   - Identification of carotid artery atherosclerosis as an incidental finding during a routine head and neck ultrasound examination;
   - Identification of schwannoma of the mid-lower neck[43];
   - Identification of lipoma[44]; and
   - Identification of Zenker's diverticulum.[45]

Mass lesions of the head and neck are often discovered on palpation or by an ultrasound survey. The discrete mass is characterized and measured in 3 dimensions. Color or power Doppler imaging is always applied to the lesion.

E. Infection and Trauma

1. Indications for ultrasound assessment of inflammatory and traumatic conditions of the neck include but are not limited to the following:
   - Identification of multiple enlarged lymph nodes with benign characteristics[16,18,19];
   - Differentiating cellulitis from abscess formation[46,47];
   - Differentiating an abscess from confluent lymphadenopathy[46,47];
   - Detection of subcutaneous emphysema in blunt neck trauma[48];
   - Identification of fractures of the laryngeal framework[49,50];
   - Identification of tracheal transection[49,50]; and
   - Detection of the size and location of hematoma.

Ultrasound is particularly useful in infectious states for both initial identification and sequential determination of treatment success. It is also particularly relevant as an intraoperative means of locating abscess formation amid confluent adenopathy. In trauma, it is noninvasive and generally directs the clinician to additional imaging tools.

F. Endocrine

Thyroid nodules are the most common lesions seen in the head and neck. A major consideration in the evaluation of thyroid nodules is the potential risk of malignancy. Ultrasound evaluation of a thyroid nodule, frequently coupled with an ultrasound-guided FNA, is the most reliable means to assess for potential malignancy. Hyperparathyroidism is a common clinical entity. While surgical excision via 4-gland exploration can be offered as therapy, directed exploration with excision of an abnormal gland is more frequently performed in patients with preoperative localization. While sestamibi imaging is commonly used, ultrasound can accurately identify the abnormal gland.

1. Indications for an ultrasound evaluation of the thyroid and parathyroid glands include but are not limited to the following:
   - Evaluation of the location and characteristics of palpable neck masses[51];
   - Evaluation of abnormalities detected by other imaging examinations or laboratory studies, eg, areas of abnormal uptake seen on radioisotope thyroid examinations[52,53];
   - Evaluation of the presence, size, and location of the thyroid gland[51];
   - Evaluation of high-risk patients for occult thyroid malignancy[54,55];
   - Follow-up of thyroid nodules, when indicated[56];
   - Evaluation for recurrent disease or regional nodal metastases in patients with proven or suspected thyroid carcinoma[54,55];

- Localization of parathyroid abnormalities in patients with suspected primary or secondary hyperparathyroidism[57–59];
- Assessment of the number and size of enlarged parathyroid glands in patients who have undergone previous parathyroid surgery or ablative therapy with recurrent symptoms of hyperparathyroidism[57];
- Localization of thyroid/parathyroid abnormalities or adjacent cervical lymph nodes for biopsy, ablation, or other interventional procedures[60];
- Identification of unsuspected thyroid pathology after parathyroid localization with sestamibi scanning[61]; and
- Localization of autologous parathyroid gland implants.[58]

High-frequency sonography is the preferred imaging tool for assessment of the size of the thyroid gland, determination of its position relative to the clavicles and sternum, and determination of the gland's internal detail. Its ability to apply specific measurements to individual lesions makes it an ideal means to compare stability or progression over time. It is the simplest, most efficient, and accurate means of producing guided needle aspiration. It is complementary to nuclear scans in assessment of parathyroid pathology.

2. Specifications of sonographic evaluation of the thyroid and parathyroid glands:

   When to perform the thyroid examination in the course of a head and neck ultrasound assessment is immaterial as long as the examiner is consistent from one procedure to another. In this way, omissions are less likely. The examination should be performed with the neck in extension and the patient either supine or semirecumbent. The right and left lobes of the thyroid gland should be imaged in at least 2 projections, in longitudinal and transverse planes. Recorded views of the thyroid should include transverse images of the superior, mid, and inferior portions of the right and left thyroid lobes; longitudinal images of the medial, mid, and lateral portions of both lobes; and at least a transverse image of the isthmus. The size of each thyroid lobe should be recorded in 3 dimensions (anteroposterior, transverse, and longitudinal). The thickness (anteroposterior measurement) of the isthmus on the transverse view should be recorded. Visualized thyroid abnormalities should be documented. The location, size, number, and character of significant abnormalities should be documented, and measurements should be made in 3 dimensions. In patients with numerous nodules in each lobe, measurements of all nodules are not necessary. The largest nodules or those with the most worrisome features should be selectively measured when multiple nodules are present. Abnormalities of the adjacent soft tissues, when encountered, such as abnormal lymph nodes or thrombosed veins, should be documented.

   Whenever possible, comparison should be made with other appropriate imaging studies. Spectral, color, and/or power Doppler ultrasound may be useful to evaluate the vascularity of the thyroid gland and of localized masses.

Sonographic guidance may be used for aspiration or biopsy of thyroid abnormalities or other masses of the neck or for interventional procedures.

Examination for suspected parathyroid enlargement should include images in the region of the anticipated parathyroid gland location. The examination should be performed with the neck extended and should include longitudinal and transverse images from the carotid arteries to the midline bilaterally and extending from the carotid artery bifurcation superiorly to the thoracic inlet inferiorly. As parathyroid glands may be hidden below the clavicles in the lower neck and upper mediastinum, it may also be helpful to have the patient swallow during the examination with constant real-time observation. The upper mediastinum may be imaged with an appropriate probe by angling behind the sternum from the sternal notch. Although the normal parathyroid glands are usually not visualized with available sonographic technology, enlarged parathyroid glands may be visualized. When visualized, the location, size, and number should be documented, and measurements should be made in 3 dimensions. The relationship of any visualized parathyroid gland(s) with the thyroid gland should be documented, if applicable.

Whenever possible, comparison should be made with other appropriate imaging studies. Spectral, color, and/or power Doppler ultrasound may be helpful.

Sonographic guidance may be used for aspiration/parathyroid hormone analysis of an atypical parathyroid issue or for cytology when an occult concurrent thyroid lesion is identified on grayscale ultrasound imaging. Aspiration is not required when there is concordance of an enlarged parathyroid gland with a nuclear scan or when the enlarged gland is in its cardinal position.

VI. Documentation

Adequate documentation is essential for high-quality patient care. There should be a permanent record of the ultrasound examination and its interpretation. Images of all appropriate areas, both normal and abnormal, should be recorded. Variations from normal size should be accompanied by measurements. Images should be labeled with the patient identification, facility identification, examination date, and side (right or left) of the anatomic site imaged. An official interpretation (final report) of the ultrasound findings should be included in the patient's medical record. Retention of the ultrasound examination should be consistent both with clinical needs and with relevant legal and local health care facility requirements.

Reporting should be in accordance with the *AIUM Practice Parameter for Documentation of an Ultrasound Examination*.

VII. Equipment Specifications

Head and neck studies should be conducted with a linear transducer. The equipment should be adjusted to operate at the highest clinically appropriate frequency, realizing that there is a trade-off between resolution and beam penetration. For most patients, mean frequencies of 8 to 12 MHz are preferred, although some patients may require a lower-frequency transducer for deeper penetration. Resolution should be of sufficient quality to evaluate the internal morphology of visible lesions. Doppler frequencies should be set to optimize flow detection. Diagnostic information should be optimized, while maintaining low total ultrasound exposure. The ALARA (as low as reasonably achievable) principle should be observed when adjusting controls that affect the acoustic output and by considering transducer dwell times. Further details on ALARA may be found in the AIUM publication *Medical Ultrasound Safety, Third Edition*.

VIII. Quality Control and Improvement, Safety, Infection Control, and Patient Education Concerns

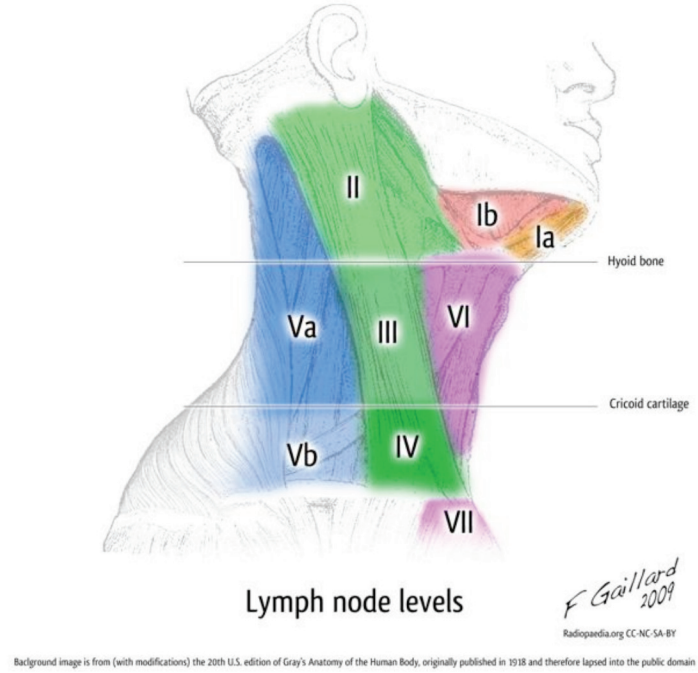
Policies and procedures related to quality control, patient education, infection control, and safety should be developed and implemented in accordance with the AIUM *Standards and Guidelines for the Accreditation of Ultrasound Practices*.

Equipment performance monitoring should be in accordance with the AIUM publication *Routine Quality Assurance for Diagnostic Ultrasound Equipment*.

IX. ALARA Principle

The potential benefits and risks of each examination should be considered. The ALARA principle should be observed when adjusting controls that affect the acoustic output and by considering transducer dwell times. Further details on ALARA may be found in the AIUM publication *Medical Ultrasound Safety, Third Edition*.

Figure 1. Levels of the neck. Reproduced with permission from Dr Frank Gaillard.



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Collaborative Committees

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