CLINICAL GUIDELINES

Neck Imaging Guidelines

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eviCore healthcare Clinical Decision Support Tool Diagnostic Strategies: This tool addresses common symptoms and symptom complexes. Imaging requests for individuals with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist and/or individual's Primary Care Physician (PCP) may provide additional insight.

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Neck Imaging Guidelines

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Abbreviations for Neck Imaging Guidelines	
ALS	amyotrophic lateral sclerosis
CT	computed tomography
ENT	Ear, Nose, Throat
FNA	fine needle aspiration
GERD	gastroesophageal reflux disease
GI	gastrointestinal
HIV	human immunodeficiency virus
MRI	magnetic resonance imaging

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General (Neck-1)

General Guidelines (Neck-1.0)

- A pertinent clinical evaluation since the onset or change in symptoms including a detailed history, physical examination, appropriate laboratory studies and basic imaging such as plain radiography or ultrasound should be performed prior to considering advanced imaging (CT, MR, Nuclear Medicine), unless the individual is undergoing guideline-supported scheduled imaging evaluation. A meaningful technological contact (telehealth visit, telephone call, electronic mail or messaging) since the onset or change in symptoms can serve as a pertinent clinical evaluation
- Advanced imaging of the neck covers the following areas:
  - Skull base (thus a separate CPT® code for head imaging in order to visualize the skull base is not necessary).
  - Nasopharynx
  - Upper oral cavity to the head of the clavicle
  - Parotid glands and the supraclavicular region
- Ultrasound of the soft tissues of the neck including thyroid, parathyroid, parotid and other salivary glands, lymph nodes, cysts, etc. is coded as CPT® 76536. This can be helpful in more ill-defined masses or fullness and differentiating adenopathy from mass or cyst, to define further advanced imaging.
- CT Neck
  - CT Neck is usually obtained with contrast only (CPT® 70491).
    - Little significant information is added by performing a CT Neck without and with contrast (CPT® 70492), and there is the risk of added radiation exposure, especially to the thyroid.
    - CT Neck without contrast (CPT® 70490) can be difficult to interpret due to difficulty identifying the blood vessels
      - Exception: Contrast is not generally used when evaluating the trachea with CT. Evaluate salivary duct stones in the appropriate clinical circumstance where intravenous contrast may obscure high attenuation stones
    - Contrast enhanced CT is helpful in the assessment of cervical adenopathy and preoperative planning in the setting of thyroid carcinomas
      - Contrast is recommended as an adjunct to US for individuals with clinical suspicion for advanced disease, including invasive primary tumor, or clinically apparent multiple or bulky lymph node involvement

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- Contrast may cause intense and prolonged enhancement of the thyroid gland which interferes with radioactive iodine nuclear medicine studies.
  - Use of IV contrast is an important adjunct because it helps to delineate the anatomic relationship between the primary tumor and metastatic disease. Iodine is generally cleared within four to eight weeks in most individuals, so concern about iodine burden from IV contrast causing a clinically significant delay in subsequent whole-body scans (WBSs) or radioactive iodine (RAI) treatment after the imaging followed by surgery is generally unfounded. The benefit gained from improved anatomic imaging generally outweighs any potential risk of a several week delay in RAI imaging or therapy. Where there is concern, a urinary iodine to creatinine ratio can be measured.

- MRI Neck
  - MRI Neck is used less frequently than CT Neck.
  - MRI Neck without and with contrast (CPT® 70543) is appropriate if CT suggests the need for further imaging or if ultrasound or CT suggests any of the following:
    - Neurogenic tumor (schwannoma, neurofibroma, glomus tumor, etc.)
    - Vascular malformations
    - Deep neck masses
    - Angiofibromas
    - Concern for malignancy (See **Squamous Cell Carcinomas of the Head and Neck (ONC-3)**, **Salivary Gland Cancers (ONC-4)**, or **Thyroid Cancer (ONC-6)** as appropriate)
  - MRI Neck without and with contrast (CPT® 70543) is also directly supported if the head and neck specialist, or the provider in consultation with the head and neck specialist, has reasonable clinical concern:
    - For a skull base or nasopharyngeal neoplasm, or potential perineural invasion/cranial nerve involvement[2]
    - That extensive dental amalgam may obscure the anatomy on CT in individuals with oral cavity neoplasm.

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Cerebrovascular and Carotid Disease (Neck-2)

Cerebrovascular and Carotid Disease (Neck-2.1)

- See these related topics in the Head Imaging Guidelines:
  - **General Guidelines – CT and MR Angiography (CTA and MRA) (HD-1.5)**
  - **Aneurysm and AVM (HD-12)**
  - **Stroke/TIA (HD-21.1)**
  - **Cerebral Vasculitis (HD-22.1)**
  - **Dizziness, Vertigo and Syncope (HD-23)**
  - **Hearing Loss and Tinnitus (HD-27)**
  - **Eye Disorders and Visual Loss (HD-32)**
- See**Cerebrovascular and Carotid Disease (PVD-3)** in Peripheral Vascular Disease Imaging Guidelines.
- See **Eagle Syndrome (Neck-10.3)**

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Dysphagia and Esophageal Disorders (Neck-3)

Dysphagia and Esophageal Disorders (Neck-3.1)

- Gastroesophageal Reflux Disease (GERD)[5,14]
  - Advanced imaging is generally not indicated for the evaluation of GERD, the diagnosis of which is usually made on the basis of clinical history, in conjunction with endoscopy, pH monitoring, Upper GI Barium Studies, and occasionally manometry. Exceptions would include the following:
    - Non-cardiac chest pain suspected of being GERD should be evaluated first to exclude cardiac and other etiologies. See **Non-Cardiac Chest Pain-Imaging (CH-4.1)** in the Chest Imaging Guidelines.
    - Gastric emptying study (CPT® 78264) for individuals with refractory GERD symptoms, and gastroparesis is being considered.
- Suspected foreign body impaction and ingested foreign bodies:[1-3]
  - Plain x-rays initial imaging.
  - If imaging is negative, or there is suspicion of a radiolucent foreign body (such as fish or chicken bones, wood, plastic, thin metal objects, aluminum can pop-ups, etc.):
    - CT Neck and/or Chest with or without contrast
    - 3-D reconstruction (CPT® 76377 or CPT® 76376) is indicated in this setting
  - The use of oral contrast is discouraged (to avoid the aspiration of contrast material) for acute dysphagia or foreign body impaction, as the contrast may not pass, may be aspirated, and can interfere with subsequent endoscopic intervention.
- Oropharyngeal or esophageal dysphagia[4,6,10,11]
  - Oropharyngeal dysphagia (difficulty in transferring food from the mouth to the pharynx)
    - Suspected neurologic causes: See appropriate sections in **Head Imaging Guidelines**
    - Video fluoroscopic swallowing study – (Dynamic radiographic evaluation of swallowing during speech pathologist-guided oral intake of various consistencies)
    - Flexible fiberoptic laryngoscopy and/or FEES (Fiberoptic Endoscopic Evaluation of Swallowing) – (Dynamic evaluation of swallowing via direct visualization using transnasal laryngoscopy during speech pathologist-guided oral intake of various consistencies)
    - CT Neck with contrast (CPT® 70491) is indicated for any anatomic abnormalities suggested on laryngoscopy exam or FEES

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- Esophageal dysphagia (difficulty in transferring food down the esophagus in the retrosternal region, e.g. food sticking in the neck or chest)
  - Initial barium esophagram or upper gastrointestinal endoscopy
  - Esophageal manometry if indicated
  - Structural lesions identified on either esophagram or laryngoscopy/upper GI endoscopy requiring further evaluation (e.g. tumors, extrinsic compression):
    - CT Neck (CPT® 70491), CT Chest (CPT® 71260) and/or CT Abdomen (CPT® 74160) depending on the level of the lesion.

- Suspected perforation, abscess, or fistula
  - CT Neck, Chest, and/or Abdomen, preferably with contrast, as requested, depending on location

- Evaluation of structural abnormalities demonstrated on either esophagram or laryngoscopy/upper GI endoscopy (e.g., external compression, tumor, stricture, diverticulum, etc.)
  - CT Chest (CPT® 71260), CT Neck (CPT® 70491), and/or CT Abdomen (CPT® 74160) depending on location

- Hiatal hernia
  - See **Hiatal Hernia (AB-12.3)** in the Abdomen Imaging Guidelines

- Globus Sensation[7-9]
  - Globus sensation is a feeling of a lump or foreign body in the throat. In general, laryngoscopy, endoscopy, and physical examination will rule out malignant causes and advanced imaging is usually not needed for evaluation.
    - If red flag symptoms are present (dysphagia, weight loss, odynophagia/ throat pain, hoarseness, hemoptysis, and/or unilateral presentation of symptoms)
      - Direct visualization with laryngoscopy and/or upper endoscopy should be performed prior to advanced imaging.
      - CT Neck with contrast (CPT® 70491) for ANY of the following:
        - Negative or equivocal findings on laryngoscopy and/or upper endoscopy
        - Known history of upper aerodigestive or esophageal malignancy
        - Known history of lymphoma
        - History of previous neck, esophageal, or gastric surgery
        - Palpable abnormality on physical examination

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- Suspected Vascular Ring[8,9,12,13,15, 16, 17] (See **Dysphagia (PEDNECK-5)**)
  - Advanced imaging can be performed if a vascular ring is suspected by, or in consultation with, the treating specialty--ie, cardiothoracic surgery, cardiology, otolaryngology, and/or pulmonology. More commonly, this congenital pathology would be suspected in a much younger population, however, dysphagia lusoria is a relatively rare condition involving a vascular ring (usually an aberrant right subclavian artery). As children these individuals are asymptomatic but develop worsening dysphagia later in adulthood, presumably secondary to increasing calcification and blood pressure.
    - CTA Chest with contrast (CPT® 71275) or MRA Chest (CPT® 71555) are the prefered imaging studies in the evaluation of a suspected vascular ring
    - CT Chest with contrast (CPT® 71260), MRI Chest without contrast, or MRI Chest without and with contrast (CPT® 71550 or CPT® 71552), can be performed as alternative exams in the evaluation of suspected vascular ring.
- Post-operative dysphagia
  - Dysphagia following surgery on the oropharynx, soft tissues of the neck, cervical spine, esophagus, or stomach:
    - In the immediate post-operative period the concern is for fluid collections, anastomotic leaks, perforations, and abscess. In the delayed post-operative period (>1 month) the concern is recurrent disease or a late post-operative fluid collection
      - CT Neck with contrast (CPT® 70491) and/or CT Chest with contrast (CPT® 71260) (IV contrast better defines the anatomic structures than a non-contrast study as soft-tissue and blood vessel enhancement are better delineated from post-operative fluid collections, such as hematomas and abscesses – Note: CT without and with contrast offers little additional benefit compared to a CT with contrast alone[10])

Background and Supporting Information

- A detailed history of the dysphagia symptoms is important to distinguish neurogenic, pharyngeal and esophageal disorders
- Dysphagia (difficulty swallowing) can be caused by a wide range of benign and malignant causes that affects the body's ability to move food or liquid from the mouth to the pharynx and into the esophagus.
- A short duration (weeks to months) of rapidly progressive esophageal dysphagia with associated weight loss is highly suggestive of esophageal cancer.
- Advanced imaging for individuals presenting with isolated globus rarely impacts clinical management. In a study of 148 neck CTs and 104 barium esophagrams done for the evaluation of globus sensation, there were no malignancies detected.

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Neck Mass/Swelling/Adenopathy (Neck-5)

Neck Mass/Swelling/Adenopathy (Neck-5.1)

- Cervical lymphadenitis is common and follows most viral or bacterial infections of the ears, nose and throat. Painful acute lymphadenopathy should be treated with a trial of conservative therapy for 2 weeks, including antibiotics if appropriate. If there is improvement with conservative treatment, advanced imaging is not indicated but if the adenopathy persists it can be imaged as per below.[1.2.4]
- Ultrasound (CPT® 76536) can be considered for ANY of the following:[1,2,4]
  - Anterior neck masses[2]
  - Cervical adenopathy/lymphadenitis or an inflammatory, infective, or reactive mass that has failed a 2 week trial of treatment or observation (including antibiotics if appropriate)[1,2]
  - Any ill-defined mass, fullness or asymmetry[2]
  - High suspicion of malignancy[2,4]
- CT Neck with contrast (CPT® 70491) can be considered if:[2,4]
  - Neck mass with any ONE of the following:
    - Non-tender neck masses[4]
    - Size ≥1.5cm[4]
    - Firm texture or fixation of the mass[4]
    - Absence of acute, uncomplicated infectious etiology[4,7]
    - Cervical adenopathy/lymphadenitis or an inflammatory, infective, or reactive mass that has failed a 2 week trial of treatment or observation (including antibiotics if appropriate)[2,4]
    - Ear pain ipsilateral to the neck mass[4]
    - Associated onset of persistent hoarseness, tonsil asymmetry, oral or oropharyngeal ulceration, hemoptysis, weight loss, or ulceration of skin overlying the neck mass[4,7]
    - History of malignancy that would be primary or metastatic to the neck[4]
    - Prior ultrasound results are suspicious or indeterminate for malignancy[2]
  - Carcinoma found in a lymph node or other neck mass[2]
  - Suspected peritonsillar, retropharyngeal or other cervical space abscess[2]
  - Suspected or known sarcoidosis[5]
  - Preoperative evaluation of any neck mass[2]
- MRI Neck without and with contrast (CPT® 70543) is supported if:[2]
  - CT suggests the need for further imaging[2]
  - Ultrasound or CT suggests neurogenic tumor (schwannoma, neurofibroma, glomus tumor, etc.), vascular malformations, deep neck masses, or angiofibroma.[2]

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- MRI Neck without and with contrast (CPT® 70543) is also directly supported if the head and neck specialist, or the provider in consultation with the head and neck specialist, has reasonable clinical concern:
  - For a skull base or nasopharyngeal neoplasm, or potential perineural invasion/cranial nerve involvement[7]
  - That extensive dental amalgam may obscure the anatomy on CT in individuals with oral cavity neoplasm.

Backgound and Supporting Information

- Painful acute lymphadenopathy associated with uncomplicated pharyngitis, URI or tonsillitis should undergo conservative therapy for two weeks including antibiotics, if appropriate. If there is improvement with conservative treatment, advanced imaging is not indicated if:[3,4,5]
  - Inflammatory neck adenopathy is often associated with upper respiratory infection, pharyngitis, dental infection, HIV and toxoplasmosis. Occasionally it is associated with sarcoidosis and tuberculosis.
- Malignancy is a greater possibility in adults that are heavy drinkers and smokers, but HPV associated disease is on the rise and there can be a high suspicion for malignancy even without these traditional risk factors.
- ENT evaluation can be helpful in determining the need for advanced imaging.
- Although CT and MRI can have characteristic appearances for certain entities, biopsy and histological diagnosis are the only way to obtain a definitive diagnosis. The preferred initial method of biopsy is Ultrasound guided core needle biopsy of the mass.[5,6]
- The most common causes of neoplastic cervical adenopathy are metastasis from head and neck tumors or lymphoma.

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Recurrent Laryngeal Nerve Palsy (Neck-7)

Recurrent Laryngeal Nerve Palsy (Neck-7.1)

- See **Recurrent Laryngeal Nerve Palsy (HD-7.1)** in the Head Imaging Guidelines

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Thyroid and Parathyroid (Neck-8)

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Thyroid Nodule (Neck-8.1)

- Serum thyrotropin (TSH) should be measured in the initial evaluation of thyroid nodule/mass/asymmetry/goiter but is not required for follow-up imaging.[1,3,6,8]
- Nuclear scan (CPT® 78013 or CPT® 78014) is indicated if the serum TSH is subnormal and ANY of the following:
  - Single or multiple thyroid nodules[1,3,6,8]
  - Suspicion of ectopic thyroid tissue[3]
  - Presence of thyroid nodule in the setting of Grave's disease.[3,8]
- Ultrasound (US) Neck (CPT® 76536) is indicated for evaluation of a palpable thyroid nodule/mass/asymmetry/goiter regardless of TSH level:[3,5]
  - Incidentally found on CT, MRI, or PET (focal activity)[2,3,6]
  - Nodules ≤1 cm with very low suspicion US pattern including spongiform pattern (>50% small cystic spaces) and pure cysts do not require repeat US.[6,10]
- ACR Thyroid Imaging, Reporting, and Data System (TI-RADS), consisting of five levels, is utilized for recommendations in determining US follow-up vs FNA of thyroid nodule(s).[10]
  - TI-RADS 1 (Benign) and TI-RADS 2 (Not Suspicious): Follow-up US is not indicated
  - Additional sonograms are indicated for more suspicious thyroid nodules that do not meet size criteria for FNA, such as TI-RADS 3 (Mildly Suspicious), TI-RADS 4 (Moderately Suspicious and TI-RADS 5 (Highly Suspicious) as follows:

ACR TI-RADS Levels for Thyroid Nodule Follow-Up Ultrasound or FNA			
TI-RADS 3 Mildly Suspicious	≥1.5 to 2.4 cm - US at 1, 3, and 5 years ≥2.5 cm - FNA	No further imaging if stable and no increase at 5 years*	TI-Rads level increases but is still below FNA range: Re-image with US in 1 year.
TI-RADS 4 Moderately Suspicious	≥1.0 to 1.4 cm - US at 1, 2, 3, and 5 years ≥1.5 cm - FNA	No further imaging if stable and no increase at 5 years*	TI-Rads level increases but is still below FNA range: Re-image with US in 1 year.
TI-RADS 5 Highly Suspicious	≥0.5 to 0.9 cm – US annually for 5 years ≥1.0 cm - FNA	No further imaging if stable and no increase at 5 years*	

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        - *If nodule enlarges on follow-up US but remains below the FNA size threshold for their ACR TI-RADS level at 5 years, additional followup US imaging at the discretion of Thyroid Specialist, Endocrinologist, Neck/Thyroid Surgeon.
    - If a TIRADS classification is not stated on a thyroid US report, clinical judgement should be used to determine appropriateness of follow-up imaging interval.
    - The American Thyroid Association guidelines from 2015 also use imaging characteristics and size for thyroid nodule risk stratificaiton however size cutoffs are slightly more generous when compared to ACR-TIRADs. Sonographic imaging and/or biopsy requests in accordance with ATA criteria are appropriate[3].
    - See **Thyroid Cancer-Surveillance/Follow-up (ONC-6.4)** for thyroid nodules that are biopsy proven thyroid cancer but are being monitored on active surveillance.
- Nuclear medicine thyroid scan (CPT® 78013 or CPT® 78014) is considered for ANY of the following (TSH is not required prior to imaging in the below settings):
    - Evaluate eligibility for radioiodine therapy[3]
    - Select nodules to biopsy in multinodular goiter even if TSH not low[1,6,8]
    - Substernal goiter with compressive symptoms (e.g. dyspnea, stridor, cough, dysphonia, dysphagia)
    - Non-diagnostic or indeterminate FNA of thyroid nodule, (e.g. follicular lesion of undetermined significance) to see if hot (functioning) nodule that may be benign vs cold nodule.
- CT Neck with contrast (CPT® 70491) or CT Neck without contrast (CPT® 70490), or MRI Neck without and with contrast (CPT® 70543). CT is preferred since there is less motion artifact than with MRI. MRI and CT **are not** indicated for routine thyroid nodule evaluation and should only be considered for:
    - Evaluation of extent of known substernal goiter[3,8]
    - Airway compression[3,8]
    - Presence of pathologic lymph nodes in cervical regions not visualized on ultrasound[3]
    - Clinically suspected advanced disease confirmed by FNA, including invasive primary tumor[3,6,8]
    - Preoperative planning for thyroid disease[3,6]
    - Fine-Needle Aspiration (FNA) is indicated for suspicious and/or large thyroid nodules prior to CT or MRI imaging[6]
- A thyroid nodule detected for the first time during pregnancy should be managed in the same way as in non-pregnant individuals, except for avoiding the use of radioactive agents for diagnostic and therapeutic purposes[3]

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Background and Supporting Information

- TI-RADS levels are determined based on the ultrasound appearance of the nodule. Grading criteria are available at https://www.acr.org/-/media/ACR/Files/RADS/TI-RADS/TI-RADS-chart.pdf?la=en
- Ultrasonography (US) is preferred over CT and MRI[1,2.3.6.8] for thyroid nodule assessment. Thyroid nodule management relies on ultrasound characteristics, TSH level and FNA biopsy, together with clinical findings.
- A thyroid nodule is distinct either on palpation or radiologically (incidentaloma). Nonpalpable nodules have the same risk of cancer as palpable. Nodules >1 cm are evaluated, while smaller nodules are generally evaluated if there are suspicious sonographic features, co-existing adenopathy or a history of radiation or cancer exists.
- Ultrasound is not used to screen: 1) the general population, 2) individuals with normal thyroid on palpation with a low risk of thyroid cancer, 3) individuals with hyperthyroidism, 4) individuals with hypothyroidism or 5) individuals with thyroiditis. Conversely, US can be considered in individuals who have no symptoms but are high risk as a result of: history of head and neck irradiation, total body irradiation for bone marrow transplant, exposure to fallout from radiation during childhood or adolescence, as well as family history of thyroid cancer syndromes such as MEN2, medullary or papillary thyroid cancer, Cowden's disease, familial adenomatous polyposis, Carney complex, Werner syndrome/progeria.
- There is insufficient evidence supporting the use of PET to distinguish indeterminate thyroid nodules that are benign from those that are malignant.
- 18FDG-PET imaging is not routinely recommended for the evaluation of thyroid nodules with indeterminate cytology. Routine preoperative 18FDG-PET scanning is not recommended.
- Incidental focal FDG-PET uptake often corresponds to a clinically relevant thyroid nodule and ultrasound is recommended in individuals with a normal life expectancy[1]. Incidentally noted diffuse thyroid FDG-PET uptake most often corresponds to inflammatory uptake, however, ultrasound should be done to ensure that there is no evidence of clinically relevant nodularity.
- Elastography provides information about nodule stiffness that is complementary to gray scale ultrasound findings in nodules with indeterminate cytology or ultrasound findings. It should not be used as a substitute for gray scale ultrasound.
- Use of ultrasound contrast medium is not recommended for the diagnostic evaluation of thyroid nodules and its current use is restricted to definition of size and limits of necrotic zones after minimally invasive nodule ablation techniques.

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Hyperthyroidism and Hypothyroidism (Neck-8.2)

- Hyperthyroidism suspected[4,7]
  - Thyroid Uptake Study (CPT® 78012 or CPT® 78014) if ONE of the following:
    - TSH below normal range and elevated free T4 and/or free T3, OR
    - Subclinical hyperthyroidism with TSH <0.1 mU/L and normal free T4 and free T3, OR
    - Subclinical hyperthyroidism with TSH below the lower limit of normal but ≥0.1 and normal free T4 and free T3 in the setting of any of the following:
      - Age ≥65
      - Symptoms of hyperthyroidism
      - Presence of cardiac disease or osteoporosis
  - Ultrasound (US) Neck (CPT® 76536) if any of the following:
    - Palpable nodule on examination
    - Nuclear scanning is suggestive of thyroid nodular disease
    - Diagnostic uncertainty regarding the etiology of hyperthyroidism based on clinical presentation and initial biochemical evaluation.
    - To evaluate thyroid dimensions for planning RAI treatment
    - Nuclear scanning is contraindicated (ie. pregnancy, breastfeeding etc).
- Hyperthyroidism on therapy---For individuals with thyroid hormone levels (TSH, free T4 and free T3) within the normal, hypothyroid, or hyperthyroid range while receiving treatment with an anti-thyroid medication (methimazole or propylthiouracil/PTU)[9]
  - Nuclear Scan (CPT® 78013 or CPT® 78014) if ONE of the following:
    - To determine the cause of hyperthyroidism if there was no diagnostic scan prior to the start of medical therapy.
    - To characterize the uptake in a thyroid nodule(s) to properly triage the nodule for FNA if there was no diagnostic scan prior to the start of medical therapy.
  - Thyroid Uptake Study (CPT® 78012 or CPT® 78014) if:
    - Plan is for radioactive iodine therapy as definitive hyperthyroidism treatment.
- Hypothyroidism: There is no role for thyroid imaging in the workup of hypothyroidism in adults. Imaging for thyroid morphology does not help differentiate among causes of hypothyroidism, and all causes of hypothyroidism will have decreased radioiodine uptake.

Parathyroid Imaging (Neck-8.3)

- Classic primary hyperparathyroidism
  - Parathyroid Planar Imaging (CPT® 78070), Parathyroid Planar Imaging with SPECT (CPT® 78071), or Parathyroid Planar Imaging with SPECT/CT (preferred study) (CPT® 78072)[2,3,5] AND/OR Ultrasound (CPT® 76536)[1,2] AND/OR 4D CT Neck without and with contrast (CPT® 70492) are appropriate if BOTH of the following conditions are met[1,2,3]
    - PTH and Calcium levels are elevated (See Background and Supporting Information).
    - Intention of the study is preoperative localization.
      - All parathyroid nuclear scan codes (CPT® 78070, CPT® 78071, CPT® 78072) include thyroid subtraction when performed and no additional thyroid nuclear scan CPT codes are required unless otherwise indicated in

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Thyroid Nodule (Neck-8.1) or **Hyperthyroidism and Hypothyroidism (Neck 8.2)**.
    - Reporting or billing CPT® 78800 for the purpose of intraoperative parathyroid localization using a gamma probe is not supported if performed along with a parathyroid nuclear scan (CPT® 78070, CPT® 78071, CPT® 78072).
    - Ultrasound (CPT® 76536) can be ordered independently to evaluate the thyroid per criteria in **Thyroid Nodule (Neck-8.1)** or **Hyperthyroidism and Hypothyroidism (Neck 8.2)**
    - 3D Imaging (CPT® 76376 or CPT® 76377) is indicated with a 4D CT Neck
  - MRI Neck without and with contrast (CPT® 70543) for cases of re-operation, difficult localization or ionizing radiation contraindication[1,6] as ordered by an Endocrinologist, Parathyroid surgeon or Radiologist or any provider in consultation with one of these specialists.
  - CT Chest with contrast (CPT® 71260) in rare circumstances in the evaluation of ectopic mediastinal parathyroid adenomas[14] as ordered by an Endocrinologist, Parathyroid surgeon or Radiologist or any provider in consultation with one of these specialists.
  - Choline PET/CT (CPT® 78815 or CPT® 78816) is considered experimental and investigational for preoperative localization in cases of primary hyperparathyroidism.[15-17]
  - Repeat imaging is supported both in individuals with prior non-localizing imaging who have not yet undergone parathyroid exploration OR in cases ofhyperparathyroidism that recurs or persists after parathyroid surgery if reimaging is being ordered by a surgeon or any provider after consultation with a surgeon with expertise in parathyroidectomy[1].

- Primary hyperparathyroidism variants
  - Primary hyperparathyroidism with non-elevated serum calcium. (Serum Calcium level normal and PTH elevated).
    - Confirmatory study is elevated ionized calcium, elevated albumin corrected calcium or elevated historic calcium levels.[1,4]
  - Hypercalcemia with inappropriately non-suppressed PTH (Calcium level elevated and PTH normal).
    - PTH level ≥25 pg/mL is consistent with primary hyperparathyroidism.
    - See Background and Supporting Information for more information.
  - Intention of parathyroid imaging should be for pre-operative localization.
  - Use the same guidance on imaging modalities as described in “classic” primary hyperparathyroidism.

Primary Hyperparathyroidism variants:

	Calcium	PTH	Confirms/strongly suggests primary hyperparathyroidism
Classic primary hyperparathyroidism	High	High	Yes

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	Calcium	PTH	Confirms/strongly suggests primary hyperparathyroidism
Primary hyperparathyroidism with non-elevated serum calcium	Normal	High	Elevated ionized albumin corrected or historic calcium levels*
Hypercalcemia with inappropriately non-suppressed PTH	High	Normal	PTH ≥25 pg/ml

- Normocalcemic hyperparathyroidism
  - Serum calcium levels (including ionized calcium levels) are always normal and PTH levels are elevated.
  - Secondary causes of PTH elevation are excluded. See Background and Supporting Information for differential diagnosis of secondary hyperparathyroidism.
  - Calcium, PTH and clinical status should be monitored annually.
    - In the event of laboratory progression to hypercalcemia, refer to "classic" primary hyperparathyroidism for imaging guidance.
    - In the event of clinical progression (decline in bone mineral density or new fracture/renal stone/nephrocalcinosis), imaging for the intent of preoperative localization is as requested by or after consultation with a specialist or any provider in consultation with a specialist[18].
- Secondary renal hyperparathyroidism
  - Serum calcium levels are low or normal (but may also be elevated in more advanced disease) and PTH levels are very elevated.
  - Imaging for the intent of preoperative localization as requested by or after consultation with a specialist if all of the following are met:
    - Individuals has stage 3a-stage 5 chronic kidney disease (GFR<60).
    - PTH level is >9x upper limit of normal reference range for the lab testing facility (~585 pg/mL) despite standard medical or pharmacologic therapy (calcimimetics, calcitriol and/or vitamin D analogs)[19].
- Tertiary hyperparathyroidism
  - Serum calcium and PTH levels are elevated as a result of long standing secondary hyperparathyroidism in individuals on renal replacement therapy or after renal transplant.
  - Imaging for the intent of preoperative localization as requested by or in consultation with a specialist.

Hyperparathyroidism subtypes:

	Calcium	PTH	Clinical Hallmarks
Normocalcemic Hyperparathyroidism	Normal	High	Calcium never elevated

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	Calcium	PTH	Clinical Hallmarks
Secondary renal Hyperparathyroidism	Low/Normal/High	Very High	Stage 3a-5 CKD, PTH >9x ULN
Tertiary Hyperparathyroidism	High	High	ESRD/renal transplant

Background and Supporting Information

- Hypercalcemia in individuals with primary hyperparathyroidism may be determined by elevated serum calcium, elevated serum ionized calcium, elevated serum calcium level corrected for albumin, or historic calcium elevation. A comparison of serial measurements of calcium is helpful in determining the presence of true hypercalcemia as calcium levels may be variable over time.
- Parathyroidectomy candidacy should be determined by the provider, however national guidelines recognize the following criteria for Surgery[1,4]
  - All individuals <50 years of age, regardless of whether objective features are present or absent.
  - All symptomatic individuals, including those with kidney stones, hypercalcemic crises, pathologic fractures or other associated symptoms.
  - Individuals with findings concerning for parathyroid cancer (very high calcium >13).
  - All asymptomatic individuals with the following:
    - Serum calcium >1.0 mg/dl (0.25 mmol/l) above the normal range
    - BMD by DEXA: T-score ≤2.5 at the lumbar spine, total hip femoral neck or distal 1/3 radius. (The forearm i.e. distal 1/3 radius is preferentially impacted by primary hyperparathyroidism as this area is rich in cortical bone.)
    - Vertebral fracture by x-ray, CT, MRI and vertebral fracture assessment
    - Estimated glomerular filtration rate of less than 60 ml/min
    - Urinary calcium excretion >400 mg in 24 hours
    - Nephrolithiasis or nephrocalcinosis by x-ray, ultrasound or CT
  - Asymptomatic individuals who cannot participate in appropriate medical surveillance
  - Asymptomatic individuals desiring definitive surgical management
- For cases of “normocalcemic hyperparathyroidism” in which primary hyperparathyroidism is not confirmed, additional investigation for secondary causes of hyperparathyroidism (renal insufficiency, hypercalciuria as a primary renal abnormality, vitamin D deficiency and gastrointestinal malabsorption problems such as short gut syndrome, celiac disease, Crohn's disease or a prior Roux-en-Y bypass surgery) is indicated[1,18].
- For cases of hypercalcemia in which primary hyperparathyroidism is not confirmed, additional consideration for other causes of hypercalcemia (malignancy including PTH-RP mediated and myeloma, granulomatous disease, FHH, medications including thiazide diuretics, excessive calcium/vitamin D supplementation and the history of or present lithium use) is indicated[1].

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Parathyroid Incidentaloma (Neck-8.4)

- A mass incidentally found on neck imaging that may represent an enlarged parathyroid gland, should prompt laboratory testing including calcium and PTH levels.[1,2,3,4,5]
  - If laboratory abnormalities suggest hyperparathyroidism, ie. "functioning parathyroid incidentaloma", See **Hyperparathyroidism (NECK- 8.3)** for imaging recommendations.
  - If there are no laboratory abnormalities and diagnoses other than parathyroid incidentaloma are suspected, See **Neck Mass/Swelling/Adenopathy (NECK-5.1)** for imaging recommendations.
  - Parathyroid nuclear scans are commonly requested for an evaluation of a PTI however the sensitivity of these scans are low in individuals with normal calcium/PTH and no clinical symptoms of primary hyperparathyroidism.[5,6] Reliance on either a positive scan or negative scan to decide if surgery is indicated is not supported by current literature.
- If a parathyroid incidentaloma is suspected on imaging prior to planned thyroid surgery or other head/neck surgery[4], the following studies are indicated if ordered by the surgical team or any provider in consultation with the surgical team:
  - Parathyroid Planar Imaging (CPT® 78070), Parathyroid Planar Imaging with SPECT (CPT® 78071), or Parathyroid Planar Imaging with SPECT/CT (CPT® 78072) AND/OR Ultrasound (CPT® 76536) AND/OR 4D CT Neck without and with contrast (CPT® 70492)
- Ultrasound (US) Neck (CPT® 76536) annually if the mass was not removed surgically[3]

Background and Supporting Information

- "Parathyroid incidentalomas" include parathyroid adenomas found unexpectedly at the time of surgery or seen on ultrasound.[1,2,3,4,5,6]
- Normal sized parathyroid glands (~6mm) are not usually identified by most imaging modalities, so enlargement warrants laboratory evaluation to rule out pathologic causes such as primary hyperparathyroidism or rarely parathyroid carcinoma.[1,2,3,4]
- Sonographic imaging features of a parathyroid incidentaloma (ovoid, hypoechoic, well circumscribed and adjacent to but separate from the thyroid either posteriorly or inferiorly) may have overlap with perithyroidal lymph nodes and exophytic thyroid nodules in a multinodular goiter.[1,2,3,4]
- The literature does report cases of pathologically confirmed parathyroid adenomas/hyperplasia in individuals with normal serum calcium and PTH levels, so these enlarged parathyroid glands, may represent an early stage of hyperparathyroidism. It is unclear what percentage of non-functioning PTIs become hyper-secreting over time, but many of these masses are surgically managed.[2,3,4,6]
- Normally sized and normally functioning parathyroid glands do not take up sestamibi or tetrofosmin.[7] The likelihood of a positive parathyroid nuclear scan is low in the setting of normal calcium and PTH levels.[5,6]

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- Parathyroid fine needle aspiration biopsy has been used historically however its diagnostic use is limited, due to the potential for hemorrhage and fibrosis which make eventual surgical dissection and pathologic interpretation more difficult.[1,4]

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Trachea and Bronchus (Neck-9)

Trachea and Bronchus – Imaging (Neck-9.1)

- Plain x-rays neck or chest and direct visualization of the upper airway (via laryngoscopy with our without bronchoscopy) are the initial imaging studies for evaluating individuals with suspected laryngotracheal pathology, prior to advanced imaging. Bronchoscopy can further evaluate the distal (endo) bronchial tree.
  - Suspected laryngotracheal disease can be identified by inspiratory or biphasic stridor and a characteristic flow-volume loop of PFTs.[1]
- CT Neck with contrast (CPT® 70491) or without contrast (CPT® 70490) and/or CT Chest with contrast (CPT® 71260) or without contrast (CPT® 71250) can be performed to further evaluate abnormalities, which include laryngotracheal or bronchial anomaly, foreign bodies, or persistent segmental or lobar lung collapse seen on other imaging studies.[1,2]
  - See Squamous Cell Carcinomas of the Head and Neck—Suspected/Diagnosis (ONC-3.1) for suspected laryngotracheal tumor.
- CT Neck with contrast (CPT® 70491) or without contrast (CPT® 70490) for suspected subglottic stenosis (SGS) (See Background and Supporting Information) after evaluation by a specialist or by a provider in consultation with a specialist who has directly visualized the upper airway.
- Expiratory HRCT (CPT® 71250) is indicated in individuals with obstructive physiology tracheomalacia.[1]
- The visualization of tracheal or bronchial “inspissation” or thickening of secretions, without an abnormality as described above, is not a risk for malignancy.[3]

Background and Supporting Information

- CT with multiplanar reformatting has proven comparable to rigid bronchoscopy with a 100% sensitivity and specificity of detecting SGS and for measuring length and grade of stenosis.[5]

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Neck Pain (Cervical) (Neck-10.1)

- Neck pain is usually related to a specific process including pharyngitis, radiculopathy, adenopathy, mass, carotid dissection and torticollis, and therefore found elsewhere in these guidelines.[1]
- For the evaluation of neck pain or other symptoms which may involve the cervical spine, including myelopathy and cervical radiculopathy[1] See **Spine Imaging Guidelines**

Torticollis and Dystonia (Neck-10.2)

Older Child (beyond infancy) or Adult[1]

- For trauma, CT Neck with contrast (CPT® 70491) and/or CT Cervical Spine without contrast (CPT® 72125) is the initial study to identify fracture or malalignment
- For no trauma, CT Neck with contrast (CPT® 70491), and/or MRI Cervical Spine without contrast (CPT® 72141), or CT Cervical Spine without contrast (CPT® 72125) is the initial study to locate a soft tissue or neurological cause
  - Positive→Further advanced imaging is not required if CT Neck or CT Cervical Spine has identified local cause
  - Negative→MRI Brain without and with contrast (CPT® 70553) to exclude CNS cause

Eagle's Syndrome (Neck-10.3)

- Also known as "Calcified stylohyoid ligament or Elongation of styloid process" syndromes. Can present with odynophagia, dysphagia, neck pain or vascular compression and may be triggered by movement. Often seen after tonsillectomy or pharyngeal trauma.[4,5]
- See **General Guidelines-Other Imaging Situations (HD-1.7)** for general imaging recommendations and **General Guidelines-CT and MR angiography (CTA and MRA) (HD-1.5)** if there is concern for carotid compression.

Background and Supporting Information

- Torticollis or cervical dystonia is an abnormal twisting of the neck with head rotated or twisted. Its causes are many and may be congenital or acquired and caused by trauma, infection/inflammation, neoplasm and those less defined and idiopathic. It occurs more frequently in children and on the right side (75%).
- Retropharyngeal space abscess could be associated with torticollis because child would not move neck freely.

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Salivary Gland Disorders (Neck-11)

Salivary Gland Disorders (Neck-11.1)

- Xerostomia (Dry Mouth)
  - Salivary Gland Nuclear Imaging (one of CPT® 78230, CPT® 78231, or CPT® 78232) can be considered for any one of the following:
    - Dry mouth and either:
      - Sjögren's syndrome
      - Sialadenitis
      - History of head or neck radiation therapy
      - History of cerebral palsy
      - Parotid mass to allow preoperative diagnosis of Warthin's tumor
- Salivary Gland Stones, Sialadenitis or Stenosis:[1]
  - CT Neck with contrast (CPT® 70491) and/or CT Maxillofacial area with contrast (CPT® 70487) or MRI Neck without and with contrast (CPT® 70543)
  - Sialography (contrast dye injection) under fluoroscopy, can be performed to rule out a stone, with post sialography CT (CPT® 70486), **or** post sialography MRI (CPT® 70540).
- Parotid or Salivary Gland Mass.
  - The following are appropriate:[2]
    - MRI Orbits/Face/Neck without and with contrast preferred (CPT® 70543), or MRI Orbits/Face/Neck without contrast (CPT® 70540) OR
    - CT Neck with contrast (CPT® 70491) preferred, or CT Neck without contrast (CPT® 70490) or CT Maxillofacial area with contrast (CPT® 70487)
    - Ultrasound (CPT® 76536) is supported as initial or additional imaging, and does not need to be completed prior to the performance of advanced imaging.

Background and Supporting Information

- CT Neck
  - CT should be performed with IV contrast to distinguish vessels from lymph nodes and to confirm if a mass is hypervascular. Dual-phase CT imaging (without and with IV contrast) is not supported. CT performed only without IV contrast may be helpful in a small minority of cases including cases of follow-up for known salivary stones.
    - A recent study in the American Journal of Neuroradiology comparing contrast enhanced and non-contrast enhanced CT in the evaluation of sialolithiasis demonstrated excellent sensitivity and specificity with no false-positive results using contrast-enhanced CT alone. Benefits of initial contrast-enhanced CT include better evaluation of the ductal system, improved soft tissue contrast in assessing salivary masses and decreased radiation dose (compared to dual phase CT imaging (without and with IV contrast)).[3]

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Sore Throat, Odynophagia, and Hoarseness (Neck-12)

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Definitions (Neck-12.0)

- Hoarseness – A symptoms of altered voice quality reported by the individual
- Dysphagia – Disordered or impaired swallowing ie. food impactions, globus sensation, choking/aspiration, regurgitation (See **Dysphagia and Esophageal Disorders (Neck-3.1)**)
- Odynophagia – Painful swallowing

Sore Throat/Throat Pain/Odynophagia (Neck-12.1)

- See **Dysphagia and Esophageal Disorders (Neck-3.1)** for dysphagia as the primary symptom.
- Sore Throat/Throat Pain/Odynophagia
  - Imaging studies are not indicated for uncomplicated viral or streptococcal pharyngitis with sore throat[3]
    - See **Neck Mass/Swelling/Adenopathy (Neck-5.1)** for suspected complications of pharyngitis/tonsillitis, such as a cervical space abscess.
  - Sore throat/throat pain/odynophagia that is persistent or progressive for two or more weeks, in spite of any treatment measures or observation:
    - Initial evaluation is laryngoscopy
      - CT Neck with contrast (CPT® 70491) or MRI Neck without and with contrast (CPT® 70543) if the initial laryngoscopy is abnormal, or it if is negative and there is a continued suspicion of submucosal tumor/lesion of the pharynx[2,4]
      - If subjective dysphagia AND odynophagia are both present and the initial laryngoscopy and neck exam are normal (ie. no cervical space abscess or post-surgical complication is suspected), then barium esophagram is indicated prior to the advanced imaging studies of the neck listed above.[5,6]
  - Alarm symptoms of persistent unilateral throat pain or odynophagia with ipsilateral referred otalgia is especially suspicious for a submucosal tumor of the head and neck.
    - Initial evaluation is laryngoscopy
      - CT Neck with contrast (CPT® 70491) or MRI Neck without and with contrast (CPT® 70543) if the initial laryngoscopy is abnormal or negative.
  - CT Neck with contrast (CPT® 70491) for postoperative throat pain or odynophagia after head and neck procedure with suspected complication of procedure.[4]

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Hoarseness (Neck-12.2)

- Laryngoscopy is the primary diagnostic modality for evaluating individuals with hoarseness. Imaging studies, including CT and MRI, are unnecessary in most individuals with hoarseness because most hoarseness is self-limited or caused by pathology that can be identified by laryngoscopy alone.
- The need for advanced imaging is based upon abnormal findings upon laryngoscopy,[1] such as:
  - Immobile or partially mobile vocal cord [See **Recurrent Laryngeal Nerve Palsy (HD-7.1)**]
  - Any growth, asymmetry, ulceration, or other suspected neoplasm of the glottis or supraglottis [See **Neck Mass/Swelling/Adenopathy (Neck 5.1)**]

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