Revised 2011 (Resolution 33)*

ACR–ASNR–SPR PRACTICE GUIDELINE FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) OF THE EXTRACRANIAL HEAD AND NECK IN ADULTS AND CHILDREN

PREAMBLE

These guidelines are an educational tool designed to assist practitioners in providing appropriate radiation oncology care for patients. They are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care. For these reasons and those set forth below, the American College of Radiology cautions against the use of these guidelines in litigation in which the clinical decisions of a practitioner are called into question.

The ultimate judgment regarding the propriety of any specific procedure or course of action must be made by the physician or medical physicist in light of all the circumstances presented. Thus, an approach that differs from the guidelines, standing alone, does not necessarily imply that the approach was below the standard of care. To the contrary, a conscientious practitioner may responsibly adopt a course of action different from that set forth in the guidelines when, in the reasonable judgment of the practitioner, such course of action is indicated by the condition of the patient, limitations of available resources, or advances in knowledge or technology subsequent to publication of the guidelines. However, a practitioner who employs an approach substantially different from these guidelines is advised to document in the patient record information sufficient to explain the approach taken.

The practice of medicine involves not only the science, but also the art of dealing with the prevention, diagnosis, alleviation, and treatment of disease. The variety and complexity of human conditions make it impossible to always reach the most appropriate diagnosis or to predict with certainty a particular response to treatment.

Therefore, it should be recognized that adherence to these guidelines will not assure an accurate diagnosis or a successful outcome. All that should be expected is that the practitioner will follow a reasonable course of action based on current knowledge, available resources, and the needs of the patient to deliver effective and safe medical care. The sole purpose of these guidelines is to assist practitioners in achieving this objective.

I. INTRODUCTION

This guideline was revised collaboratively by the American College of Radiology (ACR), the American Society of Neuroradiology (ASNR), and the Society for Pediatric Radiology (SPR).

Computed tomography (CT) is a radiologic modality for evaluating a variety of disorders involving the extracranial head and neck. CT should be performed only for a valid medical reason and with the minimum radiation dose necessary to achieve an optimal study. Additional or specialized examinations may be required. While it is not possible to detect all abnormalities using CT, adherence to the following guidelines will increase the probability of their detection.

II. INDICATIONS

A. Indications for CT of the soft tissues of the extracranial head and neck include, but are not limited to [1-37]:

1. Congenital anomalies.
2. Benign and malignant neoplasms.

3. Infections and inflammatory processes.
4. Trauma.
5. Vascular malformations.
6. Evaluation of palpable masses.
7. Radiation therapy treatment planning.
8. Follow-up after surgery, chemotherapy, or radiation therapy.
9. Hemorrhage/epistaxis.
10. Thyroid conditions.
11. Intraoperative and procedural guidance.

B. Indications for CT of the paranasal sinuses include, but are not limited to [11,35,38-51]:

1. Congenital anomalies.
2. Fibro-osseous disease.
3. Sinonasal neoplasm, including benign or malignant lesions and soft tissue or bone involvement.
4. Facial trauma.
5. Acute and chronic inflammation.
6. Follow-up after surgery, chemotherapy, or radiation therapy.
7. Radiation therapy treatment planning.
8. Hemorrhage/epistaxis.
9. Intraoperative and procedural guidance.

C. Indications for CT of the orbits include, but are not limited to [35,39-41,45,48,51-56]:

1. Congenital anomalies.
2. Proptosis.
3. Fibro-osseous disease.
4. Orbital and ocular neoplasms.
5. Trauma.
6. Infections and inflammation.
7. Thyroid orbitopathy.
8. Follow-up after surgery, chemotherapy, or radiation therapy.
9. Radiation therapy treatment planning.
10. Foreign body.
11. Diplopia.
12. Loss of vision.
13. Complications of sinusitis and sinus surgeries.

D. Indications for CT of the temporal bone include, but are not limited to [35,57-58]:

1. Conductive or sensorineural hearing loss.
2. Neoplasms.
3. Trauma.
4. Acute or chronic otomastoid inflammatory disease.
5. Preoperative evaluation prior to mastoidectomy.
6. Preoperative evaluation for cochlear implant.
7. Suspected inner ear disease.
8. Radiation therapy treatment planning.
9. Follow-up after surgery, chemotherapy, or radiation therapy.
10. Congenital anomalies.
11. Intraoperative and procedural guidance.

For the pregnant or potentially pregnant patient, see the ACR Practice Guideline for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation.

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

See the ACR Practice Guideline for Performing and Interpreting Computed Tomography (CT).

IV. SPECIFICATIONS OF THE EXAMINATION

The written or electronic request for CT of the head and neck should provide sufficient information to demonstrate the medical necessity of the examination and allow for its proper performance and interpretation.

Documentation that satisfies medical necessity includes 1) signs and symptoms and/or 2) relevant history (including known diagnoses). Additional information regarding the specific reason for the examination or a provisional diagnosis would be helpful and may at times be needed to allow for the proper performance and interpretation of the examination.

The request for the examination must be originated by a physician or other appropriately licensed health care provider. The accompanying clinical information should be provided by a physician or other appropriately licensed health care provider familiar with the patient's clinical problem or question and consistent with the state's scope of practice requirements. (ACR Resolution 35, adopted in 2006)

Head and neck CT protocols require close attention and development by the supervising physician, according to specified indications. Protocols should be reviewed periodically in order for the examinations to be optimized for image quality and opportunities for dose reduction. The supervising physician should be familiar with the indications for each examination, relevant patient history, potential adverse reactions to contrast media, exposure factors, field of view, collimation, slice intervals, and reconstruction algorithms.

With multidetector helical CT scanners, high-quality images should be reconstructed in multiple planes from a single data set, obviating the need for separate coronal and axial acquisitions and thereby minimizing radiation exposure. When the area of interest involves scans through the orbital region, attempts should be made to

minimize radiation dose to the lens. For contrast enhanced studies, split bolus technique may provide better lesion and vascular enhancement**.**

A. Neck CT

The patient should lie on the table in the supine position with the neck slightly extended to exclude the orbits, if possible. The study should be performed with the patient breathing quietly. Contiguous or overlapping sections should be obtained through the area of interest. The display slice thickness should not exceed the lesser of 3 mm or the acquisition display slice thickness. However, in pediatric patients a thicker slice of ≤5 mm may be appropriate. The gantry angle should be parallel to the hard palate. In patients with a large amount of dental hardware artifact, additional images can be performed with a different gantry angle to avoid streak artifact. All studies should be reconstructed in soft tissue algorithm. Additional reconstruction with a suitable edge-enhancing algorithm or technique to improve bone and cartilage depiction may be obtained in patients with a history of infection, tumor, or trauma. Intravenous contrast is recommended in patients without contraindications. A noncontrast study may be performed to evaluate for salivary stones or for patients undergoing radioiodine therapy for thyroid cancer. If the examination is performed for a vocal cord tumor, axial sections should be parallel to the vocal cords or hyoid bone.

Most indications for soft tissue neck CT can be evaluated with scans from the skull base (sellar floor) to the top of the aortic arch. For studies specifically performed to evaluate for vocal cord palsy, the inferior extent of the CT examination must include the right subclavian artery (right vocal cord palsy) or the aortopulmonary window (left vocal cord palsy). Very thin sections (1.0 to 1.5 mm) with multiplanar reconstructions limited to the larynx may be helpful for evaluating patients for vocal cord neoplasms. Scans obtained during phonation or Valsalva maneuver may be useful in assessing laryngeal function.

B. Sinus CT

The standard study may be performed in the coronal plane, or reconstructed in the coronal plane from a multidetector axial data set. Coronal and/or sagittal reformations from axial acquisitions may prove useful to the radiologist or the referring clinician, and can be also reconstructed. In the absence of a multidetector unit, direct coronal images or both axial and coronal images may be performed, if requested. Intravenous contrast should be used to evaluate neoplasms. Contrast is not required for evaluating facial trauma or for routine evaluation of patients with sinusitis. Contrast may be helpful to evaluate patients with sinus infection who have periorbital or facial swelling and have a clinical suspicion of abscess or complications of sinonasal infection, including intracranial extension. Studies should be reconstructed in a bone algorithm or another edge-sharpening algorithm.

1. Coronal reformats

   Coronal reformations are performed perpendicular to the plane of the hard palate from the nasal vestibule to the sella. The recommended reformat thickness should be between 1.0 and 1.5 mm.

2. Sagittal reformat

   Sagittal reformations are performed perpendicular to the plane of the hard palate through the maxillary sinuses.

C. Orbital CT

The standard examination should consist of image acquisition in the axial plane and, when using a multidetector scanner, in reconstructed coronal planes,. Direct coronal and axial images can be performed in the absence of this ability or for problem solving in the case of subtle fracture. In the absence of any contraindication, intravenous contrast should be administered when evaluating neoplasms, inflammatory disorders, and vascular lesions. Precontrast imaging is necessary when attempting to identify calcium in entities such as retinoblastoma. Studies should be reconstructed in soft tissue and bone algorithms. Head back or coronal images with or without Valsalva maneuvers may elucidate some vascular lesions.

1. Coronal imaging

   The patient should be placed in the prone position for direct coronal plane acquisition. The gantry angle should be perpendicular to the infraorbital-meatal line, while avoiding metallic dental work. If the patient cannot tolerate prone positioning, the coronal images may be attempted with maximal extension of the neck and gantry reangling. Contiguous or overlapping sections should be obtained from the orbital rim to the sella. The display slice thickness should not exceed 3 mm. When evaluating for small foreign bodies, display slice thickness should not exceed 1.5 mm. Multiplanar reformatted coronal views from direct axial imaging may be used with multidetector scanners.

2. Axial imaging

The patient should be placed in the supine position. The gantry angle should be in a plane parallel to the infraorbital-meatal line selected. Contiguous or overlapping sections should be obtained from the top of the frontal sinus and continue inferiorly through the hard palate. The display slice thickness should not exceed 3 mm. When evaluating for small foreign bodies, the display slice thickness should not exceed 1.5 mm.

D. Temporal Bone

The standard examination should consist of image acquisition in the axial and coronal planes, or with coronal reformation from a high-quality multidetector axial acquisition. Intravenous contrast may be helpful when evaluating patients with acute mastoiditis in order to evaluate patency of the adjacent transverse sinus. In the absence of any contraindication, contrast should be used when there is concern for a tumor. All studies should be reconstructed in bone algorithm. Right and left sides may be separately reconstructed using magnified small field of view. Additional reformations of a high-quality multidetector acquisition in the Poschl (parallel to the plane of the superior semicircular canal) and Stenvers (perpendicular to the plane of the superior semicircular canal) planes may provide additional useful information, particularly in the evaluation of superior semicircular canal dehiscence.

1. Axial imaging

The patient should be placed in the supine position for the axial plane. The gantry angle should be parallel to the infraorbital-meatal line. Contiguous or overlapping sections should be obtained from the superior most mastoid air cells above the bony portion of the external auditory canal (EAC) to the stylomastoid foramen inferiorly. The display slice thickness should not exceed 1.5 mm. Reconstruction of the posterior fossa using soft tissue algorithms may be performed if deemed necessary by the radiologist or referring physician.

2. Coronal imaging

The patient should be placed in the prone position for direct coronal plane acquisition. The gantry angle should be perpendicular to the infraorbital-meatal line. Contiguous or overlapping sections should be obtained from approximately level of the posterior temporo-mandibular joint anterior to the bony portion of the EAC and posterior to the bony portion of the EAC, through the entire mastoid air cells. The display slice thickness should not exceed 1.5 mm. Multiplanar reformatted coronal views from direct axial imaging may be substituted for direct coronal imaging.

V. DOCUMENTATION

Reporting should be in accordance with the ACR Practice Guideline for Communication of Diagnostic Imaging Findings.

VI. EQUIPMENT SPECIFICATIONS

A. Performance Guidelines

For patient imaging, the CT scanner should meet or exceed the following specifications:

1. Scan time: minimum, not more than 1 second.
2. Display slice thickness: minimum, not more than 1.5 mm.
3. Interscan delay: minimum, not more than 4 seconds (may be longer if intra-vascular contrast material is not used).
4. Limiting spatial resolution: must be measured to verify that it meets the unit manufacturer's specifications.
5. Table pitch: no greater than 2:1 for single-row-detector helical scanners.

B. Appropriate emergency equipment and medications must be immediately available to treat adverse reactions associated with administered medications. The equipment and medications should be monitored for inventory and drug expiration dates on a regular basis. The equipment, medications, and other emergency support must also be appropriate for the range of ages and sizes in the patient population.

C. Capability for a softcopy workstation is desirable.

VII. RADIATION SAFETY IN IMAGING

Radiologists, medical physicists, radiologic technologists, and all supervising physicians have a responsibility to minimize radiation dose to individual patients, to staff, and to society as a whole, while maintaining the necessary diagnostic image quality. This concept is known as "as low as reasonably achievable (ALARA)."

Facilities, in consultation with the medical physicist, should have in place and should adhere to policies and procedures, in accordance with ALARA, to vary examination protocols to take into account patient body habitus, such as height and/or weight, body mass index or lateral width. The dose reduction devices that are

available on imaging equipment should be active; if not; manual techniques should be used to moderate the exposure while maintaining the necessary diagnostic image quality. Periodically, radiation exposures should be measured and patient radiation doses estimated by a medical physicist in accordance with the appropriate ACR Technical Standard. (ACR Resolution 17, adopted in 2006 – revised in 2009, Resolution 11)

For further information on pediatric patients, see the Image Gently web site [59].

VIII. QUALITY CONTROL AND IMPROVEMENT, SAFETY, INFECTION CONTROL, AND PATIENT EDUCATION

Policies and procedures related to quality, patient education, infection control, and safety should be developed and implemented in accordance with the ACR Policy on Quality Control and Improvement, Safety, Infection Control, and Patient Education appearing under the heading *Position Statement on QC & Improvement, Safety, Infection Control, and Patient Education* on the ACR web site (http://www.acr.org/guidelines).

When possible, it may be prudent, particularly in pediatric and young adult patients, to consider using magnetic resonance imaging (MRI) or ultrasound instead of CT to reduce radiation dose [60-65]. In patients with biopsy proven advanced malignancies positron emission tomography (PET) CT should be considered for staging [66]. In all patients, the lowest possible exposure factors should be chosen that would produce images of diagnostic quality. This is particularly true in pediatric patients. Whenever possible, multiplanar reconstruction should be used to avoid repeated direct scans.

For specific issues regarding CT quality control, see the ACR Practice Guideline for Performing and Interpreting Computed Tomography (CT).

Equipment monitoring should be in accordance with the ACR Technical Standard for Medical Physics Performance Monitoring of Computed Tomography (CT) Equipment.

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