ACR–ASNR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) OF THE EXTRACRANIAL HEAD AND NECK

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The American College of Radiology will periodically define new practice parameters and technical standards for radiologic practice to help advance the science of radiology and to improve the quality of service to patients throughout the United States. Existing practice parameters and technical standards will be reviewed for revision or renewal, as appropriate, on their fifth anniversary or sooner, if indicated.

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PREAMBLE

This document is an educational tool designed to assist practitioners in providing appropriate radiologic care for patients. Practice Parameters and Technical Standards are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care[1]. For these reasons and those set forth below, the American College of Radiology and our collaborating medical specialty societies caution against the use of these documents 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 practitioner considering all the circumstances presented. Thus, an approach that differs from the guidance in this document, 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 this document when, in the reasonable judgment of the practitioner, such course of action is indicated by variables such as the condition of the patient, limitations of available resources, or advances in knowledge or technology after publication of this document. However, a practitioner who employs an approach substantially different from the guidance in this document may consider documenting in the patient record information sufficient to explain the approach taken.

The practice of medicine involves the science, and 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 the guidance in this document 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 purpose of this document is to assist practitioners in achieving this objective.

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1 *Iowa Medical Society and Iowa Society of Anesthesiologists v. Iowa Board of Nursing, 831 N.W.2d 826 (Iowa 2013) Iowa Supreme Court refuses to find that the "ACR Technical Standard for Management of the Use of Radiation in Fluoroscopic Procedures (Revised 2008)" sets a national standard for who may perform fluoroscopic procedures in light of the standard's stated purpose that ACR standards are educational tools and not intended to establish a legal standard of care. See also, Stanley v. McCarver, 63 P.3d 1076 (Ariz. App. 2003) where in a concurring opinion the Court stated that "published standards or guidelines of specialty medical organizations are useful in determining the duty owed or the standard of care applicable in a given situation" even though ACR standards themselves do not establish the standard of care.*

I. INTRODUCTION

This practice parameter 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. Although it is not possible to detect all abnormalities using CT, adherence to the following parameters 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. Acute and chronic infectious or inflammatory disease
4. Trauma
5. Vascular pathology, hemorrhage/epistaxis
6. Radiation therapy treatment planning
7. Follow-up after surgery, chemotherapy, or radiation therapy
8. Preoperative and intraoperative planning and/or guidance, including minimally invasive procedures
9. Thyroid abnormalities, most commonly preoperative evaluation of goiter and advanced-stage thyroid cancer (note: ultrasound is the standard evaluation of intrathyroidal nodules to determine need for fine-needle aspiration (FNA) and routine preoperative evaluation of differentiated thyroid cancer) [38].
10. Parathyroid adenoma localization
11. Cranial nerve deficits
12. Evaluation of palpable masses

B. Indications for CT of the paranasal sinuses include, but are not limited to [11,35,39-52]:

1. Congenital anomalies
2. Benign and malignant neoplasms
3. Acute and chronic infectious or inflammatory disease
4. Trauma
5. Vascular pathology or evaluation of hemorrhage/epistaxis
6. Radiation therapy treatment planning
7. Follow-up after surgery, chemotherapy, or radiation therapy
8. Preoperative and intraoperative planning and/or guidance, including minimally invasive procedures
9. Complications of sinusitis and sinus surgeries
10. Fibro-osseous lesions of the midface and sinonasal region

C. Indications for CT of the orbits include, but are not limited to [35,40-42,46,49,52-57]:

1. Congenital anomalies
2. Benign and malignant neoplasms
3. Acute and chronic infectious or inflammatory disease
4. Trauma
5. Vascular pathology or hemorrhage
6. Radiation therapy treatment planning
7. Follow-up after surgery, chemotherapy, or radiation therapy
8. Preoperative and intraoperative planning and/or guidance, including minimally invasive procedures
9. Complications of sinusitis and sinus surgeries
10. Fibro-osseous lesions

11. Proptosis
12. Thyroid orbitopathy
13. Foreign body
14. Diplopia
15. Loss of vision

D. Indications for CT of the temporal bone include, but are not limited to [35,58,59]:

1. Congenital anomalies
2. Benign and malignant neoplasms
3. Acute and chronic infectious or inflammatory disease
4. Trauma
5. Vascular pathology or hemorrhage
6. Radiation therapy treatment planning
7. Follow-up after surgery, chemotherapy, or radiation therapy
8. Preoperative and intraoperative planning and/or guidance, including minimally invasive procedures
9. Conductive or sensorineural hearing loss
10. Preoperative evaluation prior to mastoidectomy
11. Preoperative or postoperative evaluation for auditory devices
12. Suspected inner ear disease

For the pregnant or potentially pregnant patient, see the ACR–SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Patients with Ionizing Radiation [60].

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

See the ACR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography (CT) [61].

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 – revised in 2016, Resolution 12-b)

Head and neck CT protocols require close attention and development by the supervising physician according to specified indications, and by incorporating ACR Appropriateness Criteria®. Protocols should be reviewed periodically in order for the examinations to be optimized for image quality and opportunities for dose reduction. Single-phase CT (noncontrast or postcontrast) is sufficient in the vast majority of cases [62]. 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 (FOV), collimation, slice intervals, and reconstruction algorithms.

When available, dual-energy CT (DECT) may provide additional information beyond single-energy CT examinations of the neck. DECT reconstructed at low energy levels may improve visualization of primary squamous cell carcinoma [63]. DECT may also improve accuracy of assessment of laryngeal cartilage invasion [64,65]. Metal artifact can be decreased with DECT reconstructed at higher energy levels [66,67].

With multidetector 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. Patient Selection

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 [68-73]. In patients with biopsy-proven advanced malignancies, positron emission tomography (PET)- CT should be considered for staging [74]. In all patients, the lowest possible exposure factors that produce images of diagnostic quality should be chosen. This is particularly true in pediatric patients. Whenever possible, multiplanar reconstruction should be used to avoid repeated direct scans.

B. Neck CT

- Acquisition: The patient should lie on the table in the supine position with the neck slightly extended. The study should be performed with the patient breathing quietly. Initial imaging should be performed with the head tilted and/or a gantry angled to avoid streak artifact over the area of interest. If dental artifacts compromise diagnostic evaluation, additional imaging with different gantry angles and/or head tilt may be necessary. Most indications for soft-tissue neck CT can be evaluated with a scanned volume from the skull base to the top of the aortic arch. For studies specifically performed to evaluate for vocal cord palsy, the inferior extent of the CT examination should extend to the aortopulmonary window. Very thin sections with multiplanar reconstructions limited to the larynx may be helpful for evaluating patients with vocal cord neoplasms, with axial sections (or axial reformats) parallel to the vocal cords or hyoid bone.
- Reformation: All studies should be reconstructed in soft-tissue algorithm in axial, coronal, and sagittal planes. Additional reconstruction with a suitable reconstruction kernel or technique to improve bone and cartilage depiction may be obtained in at least 1 plane. Display slice thickness should not exceed 3 mm.
- Intravenous (IV) contrast versus noncontrast: IV contrast is usually recommended in patients without contraindications. For selected indications, a noncontrast examination may be obtained focused to the area of specific interest, such as concern for a foreign body, trauma, or for salivary stones.
- Special considerations: For parathyroid adenoma localization, multiple phases are often acquired, including noncontrast and postcontrast studies (often arterial and venous phases). For advanced thyroid cancer, IV contrast is preferred as it provides critical information regarding both primary and regional staging for surgical planning. Prolonged delay of radioactive iodine therapy of longer than 1 month following iodinated contrast administration is likely unnecessary and is not recommended by the American Thyroid Association (ATA) [75-77].

C. Sinus CT

- Acquisition: With a multidetector CT, axial images are most commonly performed parallel to the hard palate. The scanned volume should be from above the top of the frontal sinus and continue inferiorly through the maxillary teeth.
- Reformations: Routine axial, sagittal, and/or coronal reformations should be reconstructed. Coronal reformations are performed perpendicular to the plane of the hard palate from the nasal vestibule to the sella. Sagittal reformations are performed perpendicular to the plane of the hard palate through the maxillary sinuses.
- IV contrast versus noncontrast: Contrast is not recommended for evaluating facial trauma or for routine evaluation of patients with uncomplicated sinusitis. IV contrast should be used to evaluate neoplasms. IV contrast is also indicated to evaluate patients with complicated sinusitis as indicated by proptosis, periorbital or facial swelling, or other signs suspicious of intracranial or orbital extension.
- Special considerations: Considerations should be given to specific acquisition parameters required for image use in surgical navigation.

D. Orbital CT

- Acquisition: With multidetector CT, a standard examination should consist of image acquisition in the axial plane, with coronal and sagittal reformations. The patient should be positioned and the gantry angle should be adjusted to optimize image acquisition. The scanned volume should encompass the bony orbit.
- Reformations: All studies should be reconstructed in axial, coronal, and sagittal planes. Studies should be reconstructed in soft-tissue and bone algorithms. 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.
- IV contrast versus noncontrast: IV contrast is indicated when evaluating neoplasms, infectious/inflammatory disorders, and vascular lesions. Noncontrast imaging may be performed in selected clinical situations, such as thyroid eye disease, foreign body, and trauma.
- Special considerations: Prone, head back, or coronal images with or without Valsalva maneuvers may elucidate some vascular lesions.

E. Temporal Bone

- Acquisition: With a multidetector CT, a standard examination should consist of image acquisition in the axial plane, with coronal and optional oblique reformations. The patient should be placed in the supine position. For scanners in which the gantry can be angled, the gantry angle should be parallel to the infraorbital-meatal line. If the gantry cannot be angled, the patient should be positioned appropriately for the scanner. The scanned volume should be from above the superior-most mastoid air cells above the bony portion of the external auditory canal (EAC) through the mastoid tip inferiorly.
- Reformations: All studies should be reconstructed in bone algorithm. The display slice thickness should not exceed 1.0 mm. The right and left sides should be reconstructed in axial as well as coronal and/or oblique planes, using magnified small, reconstructed FOVs. The axial images are optimally reformatted either parallel to the plane of the hard palate or parallel to the lateral semicircular canals and coronal images perpendicular to the plane of the hard palate. Reconstruction of the posterior fossa using soft-tissue algorithm with a wide FOV is also recommended. Additional reformations of a high-quality multidetector acquisition in the short axis (or Poschl parallel to the plane of the superior semicircular canals) and long axis (or Stenvers perpendicular to the plane of the superior semicircular canals) planes may provide additional useful information, particularly in the evaluation of superior semicircular canal dehiscence.IV contrast versus noncontrast: Temporal bone CT is usually performed without contrast for conductive hearing loss. IV contrast is indicated when evaluating patients with suspected acute coalescent mastoiditis in order to look for associated complications, including venous thrombosis, and epidural and subperiosteal abscess. IV contrast is also indicated for neoplasms or suspected vascular pathology.

V. DOCUMENTATION

Reporting should be in accordance with the ACR Practice Parameter for Communication of Diagnostic Imaging Findings [78].

For specific issues regarding CT quality control, see the ACR Practice Parameter for Performing and Interpreting Diagnostic Computed Tomography (CT) and the ACR-AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring of Computed Tomography (CT) Equipment [61,79].

VI. EQUIPMENT SPECIFICATIONS

A. Performance Guidelines

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

1. Gantry rotation period: minimum, not > 1 second
2. Display slice thickness: minimum, not > 1.5 mm
3. Limiting spatial resolution: must be measured to verify that it meets the unit manufacturer’s

specifications.

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, and be consistent with local regulatory requirements. The equipment, medications, and other emergency support must also be appropriate for the range of ages and sizes in the patient population.

Equipment monitoring should be in accordance with the ACR–AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring of Computed Tomography (CT) Equipment [79].

VII. RADIATION SAFETY IN IMAGING

Radiologists, medical physicists, non-physician radiology providers**,** radiologic technologists, and all supervising physicians have a responsibility for safety in the workplace by keeping radiation exposure to staff, and to society as a whole, "as low as reasonably achievable" (ALARA) and to assure that radiation doses to individual patients are appropriate, taking into account the possible risk from radiation exposure and the diagnostic image quality necessary to achieve the clinical objective. All personnel who work with ionizing radiation must understand the key principles of occupational and public radiation protection (justification, optimization of protection, application of dose constraints and limits) and the principles of proper management of radiation dose to patients (justification, optimization including the use of dose reference levels). https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1775_web.pdf

Nationally developed guidelines, such as the ACR's Appropriateness Criteria®, should be used to help choose the most appropriate imaging procedures to prevent unnecessary radiation exposure.

Facilities should have and adhere to policies and procedures that require ionizing radiation examination protocols (radiography, fluoroscopy, interventional radiology, CT) to vary according to diagnostic requirements and patient body habitus to optimize the relationship between appropriate radiation dose and adequate image quality. Automated dose reduction technologies available on imaging equipment should be used, except when inappropriate for a specific exam. If such technology is not available, appropriate manual techniques should be used.

Additional information regarding patient radiation safety in imaging is available from the following websites – Image Gently® for children (www.imagegently.org) and Image Wisely® for adults (www.imagewisely.org). These advocacy and awareness campaigns provide free educational materials for all stakeholders involved in imaging (patients, technologists, referring providers, medical physicists, and radiologists).

Radiation exposures or other dose indices should be periodically measured by a Qualified Medical Physicist in accordance with the applicable ACR Technical Standards. Monitoring or regular review of dose indices from patient imaging should be performed by comparing the facility's dose information with national benchmarks, such as the ACR Dose Index Registry and relevant publications relying on its data, applicable ACR Practice Parameters, NCRP Report No. 172, Reference Levels and Achievable Doses in Medical and Dental Imaging: Recommendations for the United States or the Conference of Radiation Control Program Director's National Evaluation of X-ray Trends; 2006, 2009, amended 2013, revised 2023 (Res. 2d).

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 *ACR Position Statement on Quality Control & Improvement, Safety, Infection Control*, *and Patient Education* on the ACR website (https://www.acr.org/Advocacy-and-Economics/ACR-Position-Statements/Quality-Control-and-Improvement).

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Writing Committee – members represent their societies in the initial and final revision of this practice parameter

ACR	ASNR
Ashley H. Aiken, MD, Chair	Kavita K. Erickson, MD
Paul M. Bunch, MD	David A. Joyner, MD
Tabassum A. Kennedy, MD	Ryan K. Lee, MBA, MD
Richard B. Towbin, MD, FACR	David S. Liebeskind, MD, FAAN, FAHA, FANA, FSVIN, FWSO

SPR

Mai-Lan Ho, MD

Eman Mahdi, MD

Caroline Robson, MBChB

Committee on Practice Parameters – Neuroradiology

(ACR Committee responsible for sponsoring the draft through the process)

Steven W. Hetts, MD, Chair	Masis Isikbay, MD, BS
Sameer A. Ansari, MD, PhD	John E. Jordan, MD, MPP, FACR
Kristine A. Blackham, MD	Lubdha M. Shah, MD
Gerald Drocton, MD	Raymond K. Tu, MD, FACR
Kavita K. Erickson, MD	Max Wintermark, MD

Committee on Practice Parameters – Neuroradiology

(ACR Committee responsible for sponsoring the draft through the process)

Adam E. Flanders, MD

Committee on Practice Parameters – Pediatric Radiology

(ACR Committee responsible for sponsoring the draft through the process)

Terry L. Levin, MD, FACR, Chair	Jane Sun Kim, MD
John B. Amodio, MD, FACR	Jennifer A Knight, MD
Jesse Berman, MD	Jessica Kurian, MD
Tara M. Catanzano, MB, BCh	Matthew P. Lungren, MD, MPH
Harris L. Cohen, MD, FACR	Helen R. Nadel, MD
Kassa Darge, MD, PhD	Erica Poletto, MD
Dorothy L. Gilbertson-Dahdal, MD	Richard B. Towbin, MD, FACR
Lauren P. Golding, MD	Andrew T. Trout, MD
Safwan S. Halabi, MD	Esben S. Vogelius, MD
Jason Higgins, DO	

John E. Jordan, MD, MPP, FACR, Chair, Commission on Neuroradiology

Richard A. Barth, MD, FACR, Chair, Commission on Pediatric Radiology

David B. Larson, MD, MBA, Chair, Commission on Quality and Safety

Mary S. Newell, MD, FACR, Chair, Committee on Practice Parameters and Technical Standards

Comment Reconciliation Committee

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CHRONOLOGY

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