CT Protocol Review: Practical Tips for the Imaging Physicist

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Goals

- **Understand purpose and importance of CT Protocol Review**

- **Understand AAPM MPPG 1.a.**

- **Form a CT Protocol Review Committee**

- **Utilize AAPM support tools**

AAPM Resources

Task Group No. 225 – Medical Physics Practice Guidelines Task Group #2: CT Protocol Management and Review

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No Website on file. | **Wiki Lite** | **Wiki Full** | **Directory: Committee** | **Membership**

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Bylaws: Not Referenced.   **Rules:** Not Referenced.

Approved Date(s)   Start: 2/6/2012

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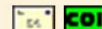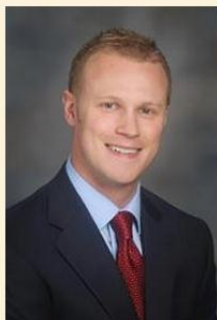
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Staff Assigned to Committee - 2013 Roster

(dates shown below are start and end dates of position. this is only viewable by EXCOM, Staff and the chair of TG225)
There are 1 staff.

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2/1/2012 AAPM Staff - *Legislative and Regulatory Affairs Manager - (ex officio, nonvoting)*

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The AAPM will periodically define new practice guidelines for medical physics practice to help

AAPM Medical Physics Practice Guideline 1.a. AAPM CT Protocol Management and Review Practice Guideline

approval of the Professional Council. The medical physics practice guidelines recognize that the safe and effective use of diagnostic and therapeutic radiology requires specific training, skills, and techniques, as described in each document. Reproduction or modification of the published practice guidelines and technical standards by those entities not providing these services is not authorized.

Approved [March 8, 2013]*

Organization of the Practice Guideline

1. Introduction
2. Definitions
3. Staffing Qualifications and Responsibilities
4. Essential Elements of the Protocol Management Process
5. Conclusion
6. References

Introduction

- The **review and management of computed tomography** (CT) protocols is a facility's ongoing mechanism of ensuring that exams being performed achieve the desired diagnostic image quality at the lowest radiation dose possible while properly exploiting the capabilities of the equipment being used.

- Therefore protocol review and management is an essential activity in ensuring patient safety and that diagnostic images are produced.

- The AAPM considers these activities to be essential to any quality assurance (QA) program for CT, and as an ongoing investment in improved quality of patient care.

Introduction

- Protocol Management refers to the process of review, implementation and verification of protocols within a facility's practice.

- This is a complex undertaking in the present environment. The challenges in optimization of dose and image quality are compounded by a lack of an automated mechanism to collect and modify protocols system-wide. The manual labor involved in identifying, recording, and compiling for review and subsequent implementation of all relevant parameters of active protocols is not inconsequential [4].

Application of the MPPG

- This MPPG **only applies** to CT scanners used for diagnostic imaging. **It is not applicable** to scanners used **exclusively** for:

  – Therapeutic radiation treatment planning or delivery;

  – Only calculating attenuation coefficients for nuclear medicine studies; or

  – Image guidance for interventional radiologic procedures.

However, CT protocol review is encouraged in these settings!!

The Team

- **Must** be responsible for protocol design and review of all parameter settings.

- Each team member brings different expertise and may have different responsibilities in the Protocol Review and Management process.

- To be successful, it is very important that the expectations of roles and responsibilities of each member are clearly described.

- The ability to work together as a team will be important attributes of each member of this group.

Responsibilities of the QMP

- In the context of CT Protocol Management and Review, the QMP's responsibilities may vary, depending on the type of facility they are supporting; regardless, the QMP **must be** involved in the review of all protocols.

- While regular dialogue is important, the QMP **should** also remember that facility personnel themselves, in particular the Lead CT Radiologist, **should** lead the CT Protocol Management and Review process; the QMP is an integral member of the team.

- These considerations **should** be balanced with adequate response times to facility inquiries.

The QMP's Time

- A QMP's time at a facility **should** include but not be limited to:
    - meeting with the CT Protocol Management and Review team; clinical observation;
    - phantom measurements; side-by-side image review with radiologist(s);
    - artifact review with technologist(s) and/or radiologist(s);
    - discussion of equipment performance and operation; etc.

In House QMP

- This ongoing CT protocol review project may consume much of his/her time, so the QMP **should** be sure to adequately communicate with his/her supervisor(s), with other team members and with department/hospital management in this regard.

- The facility **should** understand that the CT Protocol Management and Review process is an ongoing investment in improved quality of patient care.

In House QMP (continued)

- In-house QMP's may be able to arrange more frequent meetings with CT Protocol Management and Review team members than their consulting colleagues;

- Six to twelve meetings annually may be more appropriate for facilities with in-house QMP's, with the meeting frequency likely decreasing as time goes on and the facility's protocols are sufficiently improved.

Consulting QMP

- It is important to note that CT Protocol Management and Review services are above and beyond normal QMPs consulting services (e.g., the annual physics survey), which have traditionally been limited to image quality, dosimetry and basic protocol review for a few selected examinations.

- Consultant QMPs **should** make this clear to their clients, and negotiate their services appropriately.

- Consulting QMP's **should** work with the facility to arrange mutually agreeable times to visit the facility for CT protocol review activities. Three to four visits annually may be reasonable.

Qualifications and Expectation of the Lead CT Technologist

- The Lead CT Technologist is expected to provide the interface between the patient, staff and the equipment. This includes workflow, the assembly and management of the CT portfolio, and education of the technologist pool.
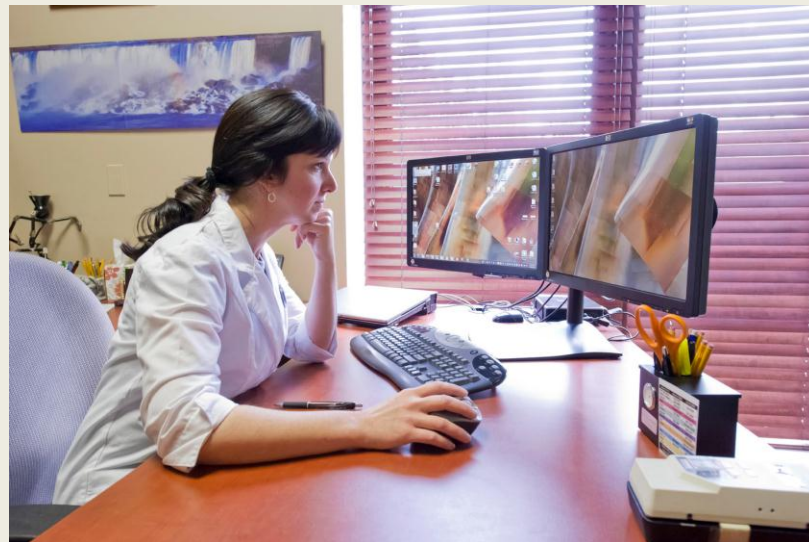
Qualifications of the CT Radiologist

- The CT radiologist leads the CT Protocol Management and Review and defines image quality requirements.

The Protocol Management Review Process

- It is important that the CT Protocol Review and Management team designs and reviews all new or modified protocol settings for existing and new scanners to ensure that both image quality and radiation dose aspects are appropriate.

- While performing the review process, the CT Protocol Management team **should** pay particular attention to the oversight and review of existing protocols along with the evaluation and implementation of new and innovative technologies that can improve image quality and/or lower patient dose in comparison to the older protocol.

The Protocol Management Review Process (continued)

- Particular attention **should** be paid to the specific capabilities of each individual scanner (e.g., minimum rotation time, automatic exposure controls including both tube current modulation as well as kV selection technologies, iterative reconstruction, reconstruction algorithms, etc.) to ensure maximum performance of the system is achieved.

- It **should** include a review of the most current literature.

Considerations Important During Review of a Protocol

- **Recommendations for State and National Guidance**
  - The QMP **must** be familiar with applicable federal law and the specific requirements for the state or local jurisdiction where the facility is located.

  - Protocol review and management, while not always explicitly required by state law or regulation, may often facilitate compliance with many provisions within state laws and regulations relating to radiation dose from CT.

Considerations Important During Review of a Protocol (continued)

- **Frequency of Review**
  - The review process **must** be consistent with federal, state and local laws and regulations.
  - If there is no specific regulatory requirement, the frequency of protocol review **should** be no less frequent than 24 months.
  - This review **should** include all new protocols added since the last review.
  - However, the best practice would be to review a facility's most-frequently-used protocols at least annually.

Considerations Important During Review of a Protocol (continued)

- **Clinically Significant Protocols that Require Annual Review**

  - If a facility performs the **following six clinical protocols**, the CT Protocol Review and Management team **must** review these annually (or more frequently if required by state or local regulatory body).

    - Pediatric Head (1 year old) (if performed at the institution)
    - Pediatric Abdomen (5 year old; 40-50 lb. or approx. 20 kg) (if performed at the institution)
    - Adult Head
    - Adult Abdomen (70 kg)
    - High Resolution Chest
    - Brain Perfusion (if performed at the institution)

Clinically Significant Protocols that Require Annual Review

- Facilities that do not perform the "six protocols" **must** select additional protocols at their facility, either the most frequently performed or higher-dose protocols, to total at least six for annual review.

Considerations Important During Review of a Protocol (continued)

- **Protocol Naming**
  - Consider naming CT protocols in a manner consistent with the RadLex Playbook ID.

  - This would provide a more consistent experience for patients and allow more direct comparison among various facilities.

  - This practice may also allow more direct utilization of the ACR Dose Index Registry tools and provide more efficient automated processes with post-processing workstations.

  - Appropriate protocol naming will likely result in fewer technologist errors and allow more efficient comparison of protocol parameters between scanners.

  - Consider incorporating version dates in protocol names to easily confirm correct version.

Considerations Important During Review of a Protocol (continued)

- **Permissions**
  - Each facility **should** decide and document who has permission to change protocol parameters on the scanner(s). If the scanner allows password protection of protocols, then the facility is encouraged to use this important safety feature. Facilities **should** also decide how passwords are protected and archived.

  - Each facility **should** decide on the process of making protocol adjustments and the frequency with which these adjustments **should** be made. This includes decisions as to what approvals need to be secured before a protocol adjustment may be made, and the documentation process (e.g., a change control log documenting the rationale for each change, as well as who authorized or motivated the change).

  - Each facility **should** consider how to most effectively utilize the NEMA XR 26 standard (Access Controls for Computed Tomography) [17] when these tools become available on scanners at their facility.

Considerations Important During Review of a Protocol (continued)

- **Acquisition Parameters should** be reviewed to ensure they are appropriate for the diagnostic image quality (noise level, spatial resolution, etc.) necessary for the clinical indication(s) for the protocol, while minimizing radiation dose. For example, a slow rotation time and/or low pitch value would not be appropriate for a chest CT exam due to breath-hold issues.

- Parameters include:
    - kV,
    - mA,
    - rotation time,
    - collimation or detector configuration,
    - pitch, etc.

Considerations Important During Review of a Protocol (continued)

- **Reconstruction parameters** **should** also be reviewed to ensure appropriate diagnostic image quality (noise level, spatial resolution, etc.) necessary for the clinical indication(s) for the protocol.

- The parameters include:
  - the width of the reconstructed image (image thickness),
  - distance between two consecutive reconstructed images (reconstruction interval),
  - reconstruction algorithm/kernel/filter,
  - the use of additional image planes (e.g., sagittal or coronal planes, etc.)

Considerations Important During Review of a Protocol (continued)

– **Advanced dose reduction techniques** **should be considered** provided the use of such techniques is consistent with the goals of the exam.

– Depending on the capabilities of each specific scanner, consider use of the following if they are available:

- Automatic exposure control (e.g., tube current modulation or kV selection) methods

- Iterative reconstruction techniques

Considerations Important During Review of a Protocol (continued)

- **Adjustments of acquisition parameters should** be adjusted for patient size, either through a series of manual adjustments or through the use of automatic techniques (such as tube current modulation methods that adjust for patient size).

Considerations Important During Review of a Protocol (continued)

- **Radiation dose management tools**
  - Radiation dose management tools that identify when potentially high radiation dose scans are being prescribed **should** be implemented when available. This includes dose reporting and tracking software, participation in dose registries and methods as described in the MITA XR25 standard ("Dose Check").

  - Radiation dose management tools may be used to monitor doses from routine exams and collect data. These would allow statistical analysis of dose parameter values for a specific exam or clinical indication (e.g., average $CTDI_{vol}$ for a routine non-contrast head). These tools include participation in a national registry (such as the ACR Dose Index Registry). There are also commercial products now available for this purpose.

Considerations Important During Review of a Protocol (continued)

- **Populating Protocols Across Scanners**
  - Each facility **should** decide on the process by which protocol parameters are populated across additional scanners (whether this is done manually or by copy/paste if the scanners allow).
  - The facility **should** decide whether there are 'master' scanners in the facility where manual protocol adjustments are to be made and archived, and that set of protocols moved to the other similar scanners, or if another strategy will be employed.

Considerations Important During Review of a Protocol (continued)

- **Documentation**
  - The CT Protocol Review and Management team **should** maintain documentation of all changes to protocols and historical protocols **should** be available for review.
  - Documentation **should** include the rationale for changes.
  - The latest protocol **should** be readily and obviously available to users during clinical protocol selection.
  - The facility **should** decide and document who is responsible for maintaining the overall protocol description documentation.
  - The facility **should** also describe whether the protocol description documentation is accessible to others for reference, how often it is updated and how all protocols are archived.

Considerations Important During Review of a Protocol (continued)

- **Periodic vendor specific education/refresher sessions**
  - Each member of the CT Protocol Management Process team **should** receive refresher training no less than annually or when new technology is introduced that substantially impacts image quality or dose to the patient.
    - Available educational resources **should** be considered in order to keep staff updated on current best practices.
    - Periodic refresher training **should** be scheduled for all members of the CT Protocol Management Process team.
    - Attendance **should** be taken at initial and all refresher training sessions, and consequences identified for failure to complete training.

Considerations Important During Review of a Protocol (continued)

- **Verification**
    - Once a CT Protocol Management Process has been established, the CT Protocol Management Process team **must** institute a regular review process of all protocols to be sure that no unintended changes have been applied that may degrade image quality or unreasonably increase dose.
    - As a best practice, the CT Protocol Review and Management team **should** conduct a random survey of specific exam types to verify that the protocols used are acceptable and consistent with protocols specified above. This **should** involve a limited review of recent patient cases to assess:
        - Acquisition and reconstruction parameters,
        - Image quality, and
        - Radiation dose.

Conclusion

- CT protocol management and review is an important part of a CT facility's operation and is considered important by many state regulatory bodies, accrediting and professional organizations.

- Protocol parameter control and periodic review will help maintain the facility's image quality to acceptable levels, and will serve to assure patient safety and continuous improvement in the imaging practice.