CT DOSE TRACKING AND PROTOCOL REVIEW

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Diagnostic Medical Physics
Department of Radiology
University of New Mexico
OVERVIEW

- Purpose
- Requirements
- Recommendations
- Application and Practice
PURPOSE

Opportunity

• To identify protocols with doses outside of National Dose Reference Levels
• To start the conversation on image quality
• To shed light on exam protocols that need more granular size/age categories
• To reveal and clean up outdated protocols
REQUIREMENTS

Rad + Tech + QMP = CT Protocol Review Committee
**Requirements**

### Acquisition and Reconstruction Parameters for Review

- Technical Factors: kV, mA, Rotation Time, Pitch
- Detector Configuration/Beam Collimation
- Reconstruction Image Thickness
- Reconstruction Algorithm or Kernels
- Specific Aspects of Acquisition Workflow
- Review of CTDIvol and Benchmarking
- Dose Reduction Options Optimization (IR/AEC)
- Review Patient Size-Based Settings
- Develop Protocol Dose Thresholds
- Review of CTDIvol Outliers
- Review Clinical Scan IQ

### Six Clinical Protocols Requiring Annual Review

- Pediatric Head (1 year old)
- Pediatric Abdomen (5 year old)
- Adult Head
- Adult Abdomen (70 kg)
- High Resolution Chest
- Brain Perfusion

### Precautions/Caveats

- Changes to protocols are agreed upon by the team
- Technologist should be in charge of making changes at the scanner
**RECOMMENDATIONS**

All the Previous Requirements PLUS:

- Clinical Observations
- Phantom Measurements
- Side-by-Side Image Review with Radiologist
- Artifact Review with Technologist and/or Radiologist
- Discussion of Equipment Performance
APPLICATION AND PRACTICE

• 3 Steps to Compliance:
  1. Obtain all protocol parameters from each scanner
  2. Put it in a usable format
  3. Radiologist, Technologist, and QMP acknowledge the protocols as they stand today and DOCUMENT review

<table>
<thead>
<tr>
<th>Protocol name</th>
<th>Range name</th>
<th>Series description</th>
<th>Ref. kV</th>
<th>kV</th>
<th>Quality ref. mAs</th>
<th>(Eff.) mAs</th>
<th>CARE kV</th>
<th>CARE Dose type</th>
<th>CTDIvol (mGy)</th>
<th>Rotating time (s)</th>
<th>Delay (s)</th>
<th>Pitch</th>
<th>Feed per scan (mm)</th>
<th>Slice (mm)</th>
<th>Acq.</th>
<th>Effective Slice (mm)</th>
<th>Position increment (mm)</th>
<th>Kernel/Algorithm</th>
<th>Window</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPPER Extremity</td>
<td>Child</td>
<td>100</td>
<td>120</td>
<td>100</td>
<td>96</td>
<td>60</td>
<td>0.6</td>
<td>CARE</td>
<td>0.5</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>64x0.6</td>
<td>0.6</td>
<td>T20f</td>
<td>Topoar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BONE SOFT</td>
<td></td>
<td>3</td>
<td>3</td>
<td>B00s</td>
<td>Osteo</td>
<td>Abdom</td>
<td></td>
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<tr>
<td>THIN</td>
<td></td>
<td>0.75</td>
<td>0.7</td>
<td>B00s</td>
<td>Osteo</td>
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<tr>
<td>SAGITT</td>
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<td>2</td>
<td>1.8</td>
<td>B00s</td>
<td>Osteo</td>
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APPLICATION AND PRACTICE

- Document with list of reviewed protocols, signatures of CT Protocol Review Team, and all parameters attached
APPLICATION AND PRACTICE

• NOW FOR THE FUN PART!
APPLICATION AND PRACTICE

• Optimization/revision with Protocol Team
  • Meet Monthly/Bimonthly to discuss Protocols
  • Use observations/conversations/outliers to start revisions and roll-out technologist education
  • Roll through sections with a 3 month time frame
**APPLICATION AND PRACTICE**

- Create a process for protocol revision
- Funnel request through section chiefs
- Encourage attachments of literature
- Technologist obtains signatures and implements protocol
- Informs physics once the protocol is on the scanner
- QMP follows up in 3 months with XR-29/LDRL value

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**Imaging Protocol Request Form**

**Requestor Information**

Requestor Name/Title: Click here to enter text.  
Date: Click here to enter a date.
Request (add/revise): Choose an item.

Addition: *(new protocol name)*: Click here to enter text.  
Revision: *(current protocol name)*:
Section: Choose an item.  
Modality *(list specific equipment/location)*: Choose an item.

Request Detail *(Please indicate specific addition/revision information, include links to journal articles and example images are appreciated)*:

Click here to enter text.

**Modality Supervisor Review**

Date Submitted for Review: Click here to enter a date.
Modality Supervisor: Click here to enter text.  
Date: Click here to enter a date.
Comments: Click here to enter text.

**Imaging Section Chief Review**

Imaging Section Chief: Click here to enter text.  
Date: Click here to enter a date.
Comments: Click here to enter text.
Approved/Disapproved: Choose an item.

**Medical Physicist Review**

Medical Physicist: Click here to enter text.  
Date: Click here to enter a date.
Comments: Click here to enter text.
Approved/Disapproved: Choose an item.
APPLICATION AND PRACTICE

• Opportunity
  • To identify protocols with doses outside of National Dose Reference Levels

U.S. Diagnostic Reference Levels and Achievable Doses for 10 Adult CT Examinations.
Kanal KM¹, Butler PF¹, Sengupta D¹, Bhargavan-Chattfield M¹, Coombs LP¹, Morin RL¹.
Opportunity

To start the conversation on image quality
APPLICATION AND PRACTICE

- **Opportunity**
- To start the conversation on image quality
Opportunity

To shed light on exam protocols that need more granular size/age categories.

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<th>NDRL CTDIvol (mGy)</th>
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<tbody>
<tr>
<td>PEDS CHEST ANGIO (All Ages)</td>
<td>0-2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
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<tr>
<td></td>
<td>3-6</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>7-10</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>11-14</td>
<td>7</td>
<td>5</td>
<td>12</td>
<td>42</td>
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<tr>
<td></td>
<td>15-18</td>
<td>6</td>
<td>7</td>
<td>11</td>
<td>20</td>
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APPLICATION AND PRACTICE

• Opportunity
  • To reveal and clean up outdated protocols

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<tr>
<th>Patient Position H-SP</th>
<th>kV</th>
<th>mAs / ref.</th>
<th>CTDIvol* mGy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topogram</td>
<td>120</td>
<td>35 mA</td>
<td>0.29 S</td>
</tr>
<tr>
<td>Head</td>
<td>120</td>
<td>227 / 273</td>
<td>36.72 S</td>
</tr>
<tr>
<td>FACIAL BONES</td>
<td>120</td>
<td>110 / 88</td>
<td>17.91 S</td>
</tr>
</tbody>
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<td>0.29 S</td>
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<tr>
<td>Head/Face</td>
<td>120</td>
<td>189 / 273</td>
<td>30.84 S</td>
</tr>
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Opportunity

To reveal and clean up outdated protocols
APPLICATION AND PRACTICE

**Opportunity**

- To reveal and clean up outdated protocols
CONCLUSION

• Protocol Review:
  • Gives opportunity
  • Is time consuming and that’s OK
  • Is prescriptive but there is still more to do/learn/optimize
  • Improve patient outcomes
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• Improve patient outcomes
QUESTIONS