Dose Management Update for Advocate Healthcare

Kenneth S Denison, PhD
August 2015
Agenda

Why radiation dose management?
Regulatory and other changes
A best practice
CT Technology update
Payers and dose
Why radiation management?
Timeline

- Incidents reported in California and Alabama
- MITA announces dose check
- Incidents reported in West Virginia
- The Joint Commission (TJC) issues alert
- Texas amends TAC to include new rules for CT
- AAPM issues CT practice guidelines
- Alaska amends AAC to include new rules for CT

2009
- NY Times publishes first article

2010
- California passes SB 1237

2011
- NY Times publishes last article (to date)
- IAEA, FDA, CRCPD et al issue call for exposure tracking

2012
- MITA endorses Smart Dose standard

2013
- TJC proposes new imaging standards

2014
- Reimbursement change included in Medicare act

2015
- TJC issues revised standards
Various organizations have announced changes intended to encourage providers to better manage protocols in CT

**ACR**

“Protocols should be reviewed for acceptable image quality for the diagnostic task required”

(ACR Quality Manual 2012)

**TJC**

“Protocols are reviewed and kept current with input from an interpreting radiologist, medical physicist, and lead imaging technologist...”

(Standard PC.01.03.01 A 25)

**AAPM**

“The AAPM considers these activities to be essential to any quality assurance (QA) program for CT...”

(AAPM Medical Physics Practice Guideline 1.a: CT Protocol Management and Review Practice Guideline)
The Joint Commission’s new imaging standards include a focus on protocol management.

The [critical access] hospital establishes or adopts diagnostic computed tomography (CT) imaging protocols based on current standards of practice, which address key criteria including clinical indication, contrast administration, age (to indicate whether the patient is pediatric or an adult), patient size and body habitus, and the expected radiation dose index range.

Diagnostic computed tomography (CT) imaging protocols are reviewed and kept current with input from an interpreting radiologist, medical physicist, and lead imaging technologist to make certain that they adhere to current standards of practice and account for changes in CT imaging equipment. These reviews are conducted at time frames identified by the [critical access] hospital.

Standard PC.01.03.01 A.25
Public awareness of medical radiation

Research commissioned by GE Healthcare, October 2012
Q1 Which of the following health news stories, if any, have you heard or read about in the past 3 months?

- Healthcare reform
- Childhood obesity
- Prescription drug safety concerns
- Childhood vaccines/potential link to autism
- Mammogram screening
- Radiation from medical imaging and therapy devices
- None of these

All respondents (N=2001)  Have heard about medical radiation (N=363)  Have not heard about medical radiation (N=1638)
Those who have heard of medical radiation are significantly more willing to undergo medical imaging procedures.
Concerns of those expressing at least some concern with radiation exposure from medical imaging procedures

Research commissioned by GE Healthcare, October 2012
Q5 For what reasons do you have concern regarding radiation exposure from medical imaging procedures?
Regulatory and other changes

Section 218: Quality incentives for Computed Tomography diagnostic imaging and promoting evidence-based care

Reduced technical fee for specific diagnostic CT imaging exams completed on systems that are not compliant with NEMA XR 29-2013

• 5% reduction starting January 2016
• 15% reduction starting January 2017 and onward

Applies to:
• Specific diagnostic CT imaging exams completed on CTs, PET/CTs, and SPECT/CTs
• Outpatient imaging exams provided by hospitals and offices/independent diagnostic testing facilities

Does not apply to:
• Interventional CT procedures
• Inpatient imaging exams
NEMA XR 29-2013 / MITA Smart Dose standard requires that a CT system include four key features

<table>
<thead>
<tr>
<th>DICOM Radiation Dose Structured Reporting</th>
<th>CT Dose Check</th>
<th>Automatic exposure controls (AEC)</th>
<th>Pediatric and adult reference protocols</th>
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<td>Enables recording of post-exam dose information in a standardized electronic format. This information can be included in the patient record, promoting the establishment of diagnostic reference levels, as well as facility dose management and quality assurance.</td>
<td>Incorporates two features—dose notifications and dose alerts—that warn operators and physicians when dose will exceed established thresholds.</td>
<td>Automatically adjust the amount of radiation within prescribed bounds as needed to achieve the desired image quality. Studies of AEC procedures have demonstrated dose reductions when used properly.</td>
<td>A set of pre-loaded parameters on a CT system that can be selected by the operator to complete a particular clinical task, such as capturing an image of the abdomen.</td>
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Joint Commission new standards

Hospitals and critical access hospitals
July 1, 2015
MR, CT, PET/CT, NM
Changes to:
• Environment of care (EC)
• Human resources (HR)
• Medication management (MM)
• Provision of care, treatment, & services (PC)
• Performance improvement (PI)
## Computed tomography changes

### Environment of care
- Quarterly occupational dose review by RSO
- Activities to maintain quality of diagnostic images
- Annual measurement and verification of displayed CTDIvol
- Annual equipment quality check
- Annual testing of image acquisition display monitors
- Shielding design assessment pre-installation
- Shielding survey post-installation

### Human resources
- Qualifications for physicists
- Annual training for technologists

### Provision of care
- Documentation of radiation dose index for every study in a retrievable format
- Pre-scan verification of patient info and protocol
- Consider patient’s age when deciding on exam type
- Adoption of protocols based on current standards of care
- Periodic review of protocols

### Performance improvement
- Review and analyze incidents where radiation dose index exceeds expectations; comparison to external benchmarks

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Getting a baseline on radiation management in CT

Baseline of CT radiation management programs
Developed from industry guidelines, research & direct observation
87 elements covering leadership, practices, technology
106 healthcare facilities have participated
Activities to maintain equipment quality

Standard EC.02.04.01 A 10

Identify activities to maintain the quality of the diagnostic computed tomography (CT) images produced

92%

Have written procedure ensuring all of the quality control, testing & maintenance are completed per manufacturer's specifications.
Annual equipment quality check

Standard EC.02.04.03 A 19
At least annually, diagnostic medical physicist conducts a performance evaluation of all CT imaging equipment. The evaluation results, along with recommendations for correcting any problems identified, are documented.

100%
CT scanners tested annually by a qualified medical physicist including dose measurements
Annual training for technologists

Standard HR.01.05.03 C 14
 Verify and document that technologists who perform diagnostic computed tomography (CT) examinations participate in ongoing education that includes annual training on the following:

• Radiation dose optimization techniques and tools for pediatric and adult patients addressed in the Image Gently® and Image Wisely® campaigns

• Safe procedures for the types of CT equipment they will use

53%
Process that ensures regular education and training on ALARA, Image Gently™, Image Wisely™, Choosing Wisely™

25%
Process that ensures regular education and training of technologists on the specific equipment being used.
Documentation of radiation dose index for every exam

Standard PC.01.02.15 C 5

Document the radiation dose index (CTDIvol, DLP, or size-specific dose estimate [SSDE]) on every study produced... The radiation dose index must be exam specific, summarized by series or anatomic area and documented in a retrievable format.

83%
Collect and store dose information from 100% of all CT exams and patients.

29%
Use a dose information system to capture, track, measure, report and analyze key dose metrics.
Pre-scan verification of patient information and protocol

Standard PC.01.02.15 A 10
Prior to conducting a diagnostic imaging study, verify the following:
• Correct patient
• Correct imaging site
• Correct patient positioning
• For CT only: Correct imaging protocol
• For CT only: Correct scanner parameters

Radiologist reviews all orders prior to the exam and ensures that the most appropriate protocol is utilized for the study.
Adoption of protocols based on current standards of care

Standard PC.01.03.01 A 25
Establishes or adopts diagnostic computed tomography (CT) imaging protocols based on current standards of practice, which address key criteria including clinical indication, contrast administration, age (to indicate whether the patient is pediatric or an adult), patient size and body habitus, and the expected radiation dose index range.

39%
Have a documented approach or process for protocol optimization and management.

42%
Dose Check installed, established Notification and Alert Values and entered them into all protocols.
Periodic review of protocols

Standard PC.01.03.01 A 25
Diagnostic computed tomography (CT) protocols are reviewed and kept current with input from an interpreting radiologist, medical physicist, and lead imaging technologist to make certain that they adhere to current standards of practice and account for changes in CT imaging equipment. These reviews are conducted at time frames identified by the hospital.

50%
Conduct regular reviews of best and better practices.

24%
Documented change history file that lists who made the change, when and why.

18%
Record of all feedback, analysis, actions taken and resolution.
## Opportunity

<table>
<thead>
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<th>Percentage</th>
<th>Description</th>
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<tr>
<td>92%</td>
<td>Person accountable for protocol optimization and management</td>
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<tr>
<td>24%</td>
<td>Protocol change history file including who, when, why</td>
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<tr>
<td>93%</td>
<td>Person accountable for protocol feedback and quality assurance</td>
</tr>
<tr>
<td>18%</td>
<td>Record of protocol feedback, analysis, actions taken and resolution</td>
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Key opportunity to formalize & document processes that are today run by passionate, dedicated individuals
A best practice
What if someone could provide you with dose-optimized protocols for your GE scanners and kept them current?

150+

patient-size adjusted, dose-optimized protocols designed for GE scanners for both adults and pediatrics
Would it be good if the protocols were designed using industry standards for quality assurance?

ISO 9000 compliant quality management system used for validation and verification of the optimized protocols
What if there thousands of exams standing behind the quality of the protocols?

40,000+ clinical data points used for validation and verification
What if the set of protocols was extensive enough to cover most of the clinical applications you use everyday?

- **Body imaging**: 22 applications, 60 protocols total for small, medium, and large adults.
- **Neuro imaging**: 19 applications, 26 protocols for adults with and without metal and 4 pediatric protocols.
- **MSK imaging**: 6 applications, 14 protocols total for medium, large adults with and without metal.
- **Chest imaging**: 2 applications, 6 protocols total for small, medium, large adults.
- **Cardio-vascular imaging**: 3 applications, 6 protocols total for medium and large adults.
- **Pediatric imaging**: 10 applications, 50 protocols total for five pediatric groups.
Dose-optimized protocols designed, developed and validated by the experts at the University of Wisconsin-Madison

Available for Optima CT660, Discovery CT750 HD, Revolution HD and Revolution GSI

Works-in-progress for Revolution EVO

60 adult clinical applications with 1-3 patient sizes for each (112 total protocols)

11 pediatric clinical applications with up to 5 patient sizes for each (54 total protocols)

Developed, optimized, verified and validated using rigorous ISO-9000 style processes and procedures
What you might gain from using standardizing with the UW-Madison dose-optimized protocols

1. Easily standardize across your system with protocols that leverage the full capabilities of each GE device

2. Deliver consistent image quality and dose using protocols developed for specific clinical tasks and tested to exacting standards

3. Lower your costs by minimizing the work your team must do to develop and optimize protocols
Protocol development is hard and expensive... what you might save from using the UW-Madison set of optimized protocols

$867,000

UW’s cost to develop the protocols

1. Estimate from the University of Wisconsin, data on file.
Who benefits the most from the use of dose-optimized protocols?
CT technology update
Notices (1 of 2)

ASiR, ASiR-V, Optima, Revolution and SnapShot are all trademarks of General Electric Company

In clinical practice, the use of ASiR or Veo iterative reconstruction may reduce CT patient dose depending on the clinical task, patient size, anatomical location, and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate
In clinical practice, the use of ASiR-V may reduce CT patient dose depending on the clinical task, patient size, anatomical location, and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the particular clinical task. Low contrast detectability (LCD), image noise, spatial resolution and artifacts were assessed using reference factory protocols comparing ASiR-V and FBP. The LCD measured in 0.625 mm slices and tested for both head and body modes using the MITA CT IQ Phantom (CCT183, The Phantom Laboratory), using model observer method.
# GE family of CT scanners

## Smart technologies

<table>
<thead>
<tr>
<th>Revolution ACTs</th>
<th>Brivo CT385</th>
<th>Brivo CT325</th>
<th>Brivo CT315</th>
<th>Optima CT540</th>
<th>Optima CT520</th>
<th>Discovery CT590 RT</th>
<th>Optima CT580 RT</th>
<th>Optima CT580 W</th>
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## Iterative reconstruction

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36
What if one CT could meet all your needs?
Technology engineered to wow.

- Performix HDw tube
- 3D collimator
- Detector module
- Gemstone Clarity Detector
- Ultra-fast kV switching generator
- Contactless slip ring and Whisper Drive system
Pediatric imaging

Minimal sedation, contrast and exposure

Sedation-free and short breath hold scans with sub-second whole abdomen/pelvis

Low dose 70 kV protocols

Personalized beam collimation for every exam
Pediatric thoracic aorta at 70 kV

Acquisition
14 year old patient
70 kV
355 mA
2 axial volumes
0.28 sec rotation
DLP 29 mGy.cm
0.43 mSv'
Low dose head

Acquisition

Pediatric patient (17y)
Axial 160 mm
1 sec acquisition
1 rotation
120 kV
170 mA
DLP 489 mGy.cm
1.1 mSv¹
Sub-millisievert pediatric abdomen pelvis at 70 kV

Acquisition
9 year old
79 lbs
Axial 2 volumes
70 kV
0.43 mSv¹
ASiR-V - routine low-dose imaging

A novel technology with goals of:

- Reduce dose up to 82% versus FBP at the same image quality
- Improve LCD up to 135% at the same dose
- Reduce image noise up to 91% at the same dose
- Improve spatial resolution up to 2x at the same image noise
- Reduce streak artifacts compared to FBP

In clinical practice, the sequence of iterative reconstruction may reduce CT patient dose depending on the clinical task, patient size, anatomical location, and clinical practice. A consultation with a radiologist and physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the particular clinical task.
Lower noise and artifact pelvis

Acquisition
Helical
120 kV
118-244 mA (3D modulation)
27.6 noise index
0.625 mm slice
64 x 0.625 detector
40 mm collimation
0.5 sec/rot
55.0 mm/rot table speed
1.375 pitch
416 mm coverage in 3.78 sec
Standard kernel + ASiR-V 80%

FBP

Standard kernel with ASiR-V 80%
Low-dose cardiac CTA 0.34 mSv

Acquisition
Snapshot Pulse (cardiac cine)
80 kV
250 mA
0.625 mm slice
64 x 0.625 detector
40 mm collimation
0.35 sec/rot
Standard kernel + ASiR-V 80%
75% Phase
56 – 59 BPM
Low-dose routine head at 1.33 mSv

Acquisition
Helical
120 kV
200-282 mAs (3D modulation)
2.8 noise index
0.625 mm slice
32 x 0.625 detector
20 mm collimation
2.0 sec/rot
5 mm/4i
Standard kernel + ASiR-V 50%
CTDIvol 45.4 mGy
DLP 637.6 mGy-cm
Payers and dose
Payers value low-radiation imaging

Percentage of fully-insured employers likely to pay for low-radiation imaging

- Premium increase
  - 1%: 21%
  - 0.50%: 29%
  - 0.10%: 68%

Percentage of self-funded employers likely to pay for low-radiation imaging

- Imaging cost increase
  - 10%: 5%
  - 5.00%: 33%
  - 1.00%: 68%

Source: 2012 Harris Survey of 250 US employers conducted for GE. Includes respondents who indicated they would be willing to pay more for low-dose imaging.
Payers value low-radiation imaging

Dose management practices position providers as a leader in quality with payers and patients

Payers and patients intuitively understand that reducing radiation while preserving quality of diagnostic information is desirable

Highlighting a provider’s support for low-radiation imaging would position it as:
• An innovator
• A leader in patient safety and quality
• A leader in healthcare

Becoming a low-radiation provider has the potential for increased revenue and market share
Various organizations have announced changes intended to encourage providers to better manage protocols in CT

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