Financial Disclosures

- Research Grants
  - Siemens Healthcare
  - Toshiba (Canon) America Medical Systems
  - AHRQ (National Institute of Health)

Dose Tracking at MGH

- Software
  - Radimetrics, Bayer
  - ACR Dose Index Registry
Tracking and Cracking: Personnel

- Medical Physicist (PhD: Lead)
  - Dose tracking (Radimetrics)
  - ACR DIR
- CT Quality Assurance Manager (RTR - CT)
  - Protocol maintenance

<table>
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<tr>
<th>ADULTS.....CT</th>
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<tr>
<td>Head</td>
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<td>Neck AND C -Spine</td>
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<td>Neck CTA</td>
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<td>Chest AND T-Spine</td>
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Scanner Notification

Reports

- Weekly/Quaterly review of Dose tracking
  - Medical Physicist
  - CT QA manager
- Quarterly review of Doses from ACR DIR
  - Medical physicist
  - Radiology Quality and Safety Committee

Issues with Reports: Radiologists

- Abdominal
- Cardiac and Vascular
- Emergency
- Chest
- Neuroradiology – Separate personnel for Adults & Children
- Pediatrics
- Musculoskeletal
Cardiac CT Dose Tracking

Sequence of Dose Utilization

1. Appropriateness
   - Just right indication with Decision Support
2. Indication based dose optimization
   - CT protocols based on clinical indications
3. Patient size based dose adjustment
   - Separating children from adults
   - Automatic exposure control
   - Automatic tube potential selection

Kalra et al. Radiographics 2015
Issues with Dose Tracking

- Variety of CT scanners
- Variety of CT protocols
- Multi-phase or multiple-run CT
- Bariatric patients
- Hardware
- Arms in wrong places - by side of body or head

Scanners

- 24 CT
- GE
- Philips
- Siemens

Sorting Protocols

- Multiple protocols
- Multiple nomenclature
CTA- Head and Neck

- DLP above the 75th percentile in ACR DIR
  - Non contrast CT
  - Post contrast arterial phase
  - Delayed phase

Trouble shoot
- Reduce kV
- Reduce dose for non-contrast and delays

Bariatric Issues

CT Myelogram
- Frequent culprit
- Particularly with hardware
High Frequency Issues

MGH Imaging CT Dose Quarterly Review Report
For high dose body cases, three major challenges:

1. CTA NECK W/DELAYS 3/2015 (CT19): shoulders included for TCM.
2. Myelogram: clinically challenging cases.
3. Pelvis hardware.
4. Bariatric patients

Protocols needing modification from this review:

1. CT19: cap the mA on the CTA head and neck at 350 mA.
2. Increase notification level to 45 mGy on the Myelograms w/o hardware and 60 mGy with hardware.
3. Pelvis hardware (CT4B, CT3W, CT3WA AND CT3NS) - Change the Rotation Time to 0.6 seconds.

Dose Notification for Head CT

Cervical Spine (CTDI vol 36 mGy)?

Too long cervical spine CT
Large patient with large shoulders
Dose modulation or AEC
CTDvol
68 mGy

Too early start:
12 sec
Too long continued:
49 seconds

CT Dose Monitoring

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<tr>
<th>Date</th>
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Lessons on Managing Dose

- Continuous dose monitoring while maintaining quality
- Tailoring radiation dose to clinical indication
- Adapting doses to patient body habitus
- CT radiation dose will exceed the notification values and certainly can be higher than DRLs

Summary from MGH Dose Tracking

- Boss is always right
  - Medical physicists better at tracking than MD
  - Dose tracking and optimization are dynamic and ongoing
- Teamwork is a must
  - Team work: Medical Physicist (lead), CT RTR, Radiologists
- Dose tracking is the right thing to do
  - Helps identify issues
  - Helps fix issues (some)
  - Not all problems are fixable !!

Acknowledgement

- Medical Physicists at MGH
  - Bob Liu, PhD; Kai Yang, PhD; Matthew Delorenzo, PhD
- CT technologists at MGH
  - Cristy Savage, CT QA manager
- CT protocols in-charge radiologists