Dose Metrics in the Patient Report: Myopic or Foresighted?

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Followed highly publicized incidents in CA of gross CT overdose: C/spine CT young boy with neck pain; >200 patients brain perfusion scans

Reporting Requirements (effective 7/1/2012)
- Record dose in PACS and radiology report
- Computed tomography dose index (CTDIvol)
- Total Dose length product (DLP)

Reporting requirements included mistaken repeat scan, wrong location, fetal exposure when dose >50mSV

Physicist monitoring requirements (2012 revision mandates CT accreditation)
Zucker et al: Radiologist Compliance with California CT Dose Reporting Requirements: a single center review of Pediatric Chest CT AJR 2015 204(4): 810

- Retrospective review
- All pediatric chest CT exams (7/1/2012 - 6/30/2013)
- Radiology report vs. CT dose page on PACS
Results: Accurate Documentation

- CTDIvol + DLP Phantom Size
  - 599/655 (91%)
  - 56/655 (9%)
  - (97%)
  - (3%)

Legend:
- No
- Yes
Dose Report Statement:

“Based on a **32 cm phantom**, the estimated radiation exposure/slice (**CTD\text{vol} [mGy])** for each series in the exam are: (**), (**), and (**). The estimated cumulative exposure (**DLP mGy-cm**) is: **.”
Dose Report Statement:

“Based on a 32 cm phantom, the estimated radiation exposure/slice (CTD\text{dvol} [\text{mGy}]) for each series in the exam are: (21.54), (23.61), and (22.55). The estimated cumulative exposure (DLP mGy-cm) is: 67.7.”
Results: Report Compliance

- CTDI vol/DLP:
  - 65/664 (10%)
  - 599/664 (90%)
- Phantom size:
  - 583/664 (88%)

Legend:
- Red: No
- Orange: Yes
Dose Report Statement:

“Based on a 32 cm phantom, the estimated radiation exposure/slice (CTD\textsubscript{vol} [mG\textsubscript{y}]) for each series in the exam are: (3.56) and (0.78). The estimated cumulative exposure (DLP mG\textsubscript{y-cm}) is: 107 for series 1 and 17 for series 2.”
Dose Report Statement:

“Based on a **32 cm phantom**, the estimated radiation exposure/slice (**CTDIvol** [mGy]) for each series in the exam are: (9.67). The estimated cumulative exposure (**DLP** mGy-cm) is: **221.18**.”
Dose Report Statement:

“Based on a **32 cm phantom**, the estimated radiation exposure/slice (**CTD\text{vol} [\text{mGy}]**) for each series in the exam are: (3.54), (0.13), (0.16) and (3.19). The estimated cumulative exposure (**DLP** mGy-cm) is: **267**.”
Conclusions

- Consistent dose reporting of just CTDI and DLP: more difficult than it seems!
- Much variation in dose reporting format
- Solutions?
  - High-reliability automated systems
  - Better-defined standards

- “The compelling and continuing issues of quality control and overprescribing in medical imaging do need to be addressed”
- “Voluntary standards have not been ineffective, but the positive mammography experience in transitioning from voluntary to mandatory standards demonstrates that legislation can be much more effective in improving quality control”
- “Other alternatives such as tort reform and payment system reform should be considered in parallel”
Myopic or foresighted?
Mezrich JL, Siegel EL. Dose reporting legislation in California: are we placing the idea of patient safety ahead of reality? J Am Coll Radiol 2013; 10:814

- “California plan compiles information that is neither entirely accurate nor reliable and will be potentially misleading to patients, the overwhelming majority of whom will have no clear idea how to use or interpret this information”

- “In the world of litigation, however, the program represents a trend that has plaintiffs' attorneys licking their collective chops”

- “The new legislation, based on the best intentions of better communication, may do more to handcuff radiologists than benefit patients”
Dose Documentation

- Myopic

- Non standardized, Non automated
- Prone to errors and inaccuracies
- Parameters reported not really useful, do NOT reflect actual patient exposure, no relation to age, sex, size or cumulative exposure
- Still need physicist to calculate actual exposure
- No reference/index levels or recommendations except reporting errors with hugely excessive exposure > 50mSV
- Hampers radiologist ability to increase dose when appropriate
- Creates platform for lawsuits
- Doesn’t go far enough to regulate or standardize CT imaging
Dose Documentation - Foresighted

- Assuage public CT fear and hysteria
- Leaders care and have regulated CT imaging and curtailed gross radiation overdose
- Quality control measure, promotes more consistency in CT imaging across state
- Greater awareness and understanding of radiation dose, appropriateness of CT studies
- Technologists, radiologists, trainees, clinicians? families see numbers and can ask questions
- Provides some form of accountability
- Some documentation of dose, later review and indexing
- Changes attitudes and behavior
Changes

- Hospitals/imaging centers review and update adult and pediatric protocols
- Revision of workflow practices and checks
- Develop procedures for incident prevention and management
- Adopt new technology and software to track and maintain dose
- ACR/other groups establish dose index registries, ACR accreditation
- Local/national medical centers, physician groups developed more stringent, more meaningful standards
- Dissemination of CT regulation/oversight
  - Other states with legislation (Texas, NY, CT)
  - Joint commission-new CT oversight requirements (CA—national)
  - Medicare payment reduction without CT dose monitoring/regulation
Thank you!