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Frequency of Recurrent CT Examinations among Patients with High Cumulative Dose and/or Number of CT Examinations

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Purpose

- With the help of dose management software:
  - What are some cumulative effective doses patients with multiple CT studies are exposed to?
  - Does high number of CT examinations result in highest cumulative dose?
  - Patients' demographics – What procedures result in high cumulative doses?
  - Opportunities to reduce dose?
  - Flag potentially redundant CT scans?

Introduction

- Motivations behind the study:
  - Based on AAPM position statement on radiation from medical imaging procedure: Possible risks from cumulative effective doses of above 100 mSv
    - What are typical cumulative doses for patients with multiple CT studies?
    - Are they above 100 mSv?

Introdcution

POLICY NUMBER	POLICY NAME	POLICY DATE	SUNSET DATE
PP 25-A	AAPM Position Statement on Radiation Risks from Medical Imaging Procedures	12/13/2011	12/31/2016

Policy source

Policy text

The American Association of Physicists in Medicine (AAPM) acknowledges that medical imaging procedures should be appropriate and conducted at the lowest radiation dose consistent with acquisition of the desired information. Discussion of risks related to radiation dose from medical imaging procedures should be accompanied by acknowledgement of the benefits of the procedures. Risks of medical imaging at effective doses below 50 mSv for single procedures or 100 mSv for multiple procedures over short time periods are too low to be detectable and may be nonexistent. Predictions of hypothetical cancer incidence and deaths in patient populations exposed to such low doses are highly speculative and should be discouraged. These predictions are harmful because they lead to sensationalistic articles in the public media that cause some patients and parents to refuse medical imaging procedures, placing them at substantial risk by not receiving the clinical benefits of the prescribed procedures.

AAPM members continually strive to improve medical imaging by lowering radiation levels and maximizing benefits of imaging procedures involving ionizing radiation.

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- The Joint Commission Diagnostic Imaging Requirements

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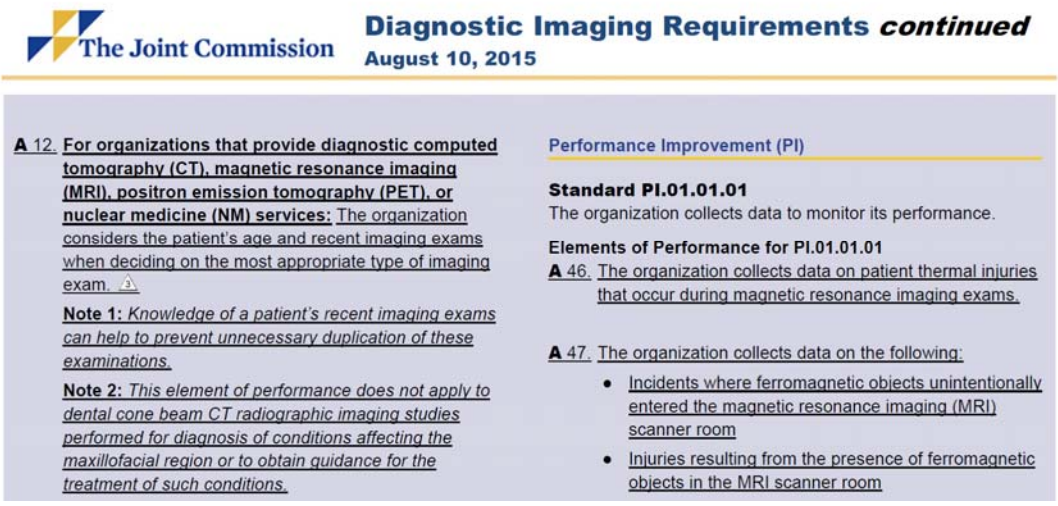
Introduction



The Joint Commission

Diagnostic Imaging Requirements *continued*

August 10, 2015

A 12. **For organizations that provide diagnostic computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET), or nuclear medicine (NM) services:** The organization considers the patient's age and recent imaging exams when deciding on the most appropriate type of imaging exam. 3

Note 1: *Knowledge of a patient's recent imaging exams can help to prevent unnecessary duplication of these examinations.*

Note 2: *This element of performance does not apply to dental cone beam CT radiographic imaging studies performed for diagnosis of conditions affecting the maxillofacial region or to obtain guidance for the treatment of such conditions.*

Performance Improvement (PI)

Standard PI.01.01.01

The organization collects data to monitor its performance.

Elements of Performance for PI.01.01.01

A 46. The organization collects data on patient thermal injuries that occur during magnetic resonance imaging exams.

A 47. The organization collects data on the following:

- Incidents where ferromagnetic objects unintentionally entered the magnetic resonance imaging (MRI) scanner room
- Injuries resulting from the presence of ferromagnetic objects in the MRI scanner room

Introduction

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Methods

- Query UCLA CT dose database from Jan 2015 to Jan 2016
- Sort patients using a threshold of 100 mSv cumulative effective dose
  - Further sort patients using # of CT examinations
- Collect patient imaging history for
  - Top 10 patients in the "highest cumulative effective dose" category
  - Top10 patients in the "highest number of examinations" category

Methods

- Imaging histories of top 20 patients were reviewed and investigated by 3 radiologists for:
  - Appropriateness of recurrent studies
  - Potential opportunities for reducing # of exams and dose
- Timed review process

Results

- A total of 34672 patients from Jan 2015 to Jan 2016
- 927 (2.7%) were identified with a cumulative effective dose of 100 mSv and above, from which1/3 were trauma patients
- Top 10 highest cumulative effective dose: 376 to 842 mSv
  - Predominantly patients with IR/ablative procedures
  - 842 mSv –patient with 2 DX scans and 9 interventional ablative CT guided procedures

Results

- Top 10 highest # of CT examinations: 25 to 56 exams
  - Predominantly head trauma patients
  - 56 exams – 17 year old head trauma patient (deceased)
- 442 total reviewed individual CT scans
  - One possible CT scan that could have been avoided
    - scan was performed to assess liver transplant to look for flow and could have possibly been done with ultrasound as per reviewing radiologist
  - Review process of an average of 20 min per patient

Results

- There was no overlap between patients from each category,
- Top five most frequently performed examinations in a year
  - Abdomen/Pelvis w/ contrast
  - Chest w/ contrast
  - Oncology chest w/ contrast and Abd/Pel w/ w/o contrast
  - Brain w/ contrast
  - Chest w/o contrast

Conclusion

- Cumulative doses can be surprisingly high
  - Academic medical center performing complex, unusual interventional procedures
  - #1 trauma center in the area
- Most exams appear to be warranted and necessary
  - Limited number of patients were reviewed as compared to the number of patients received cumulative effective doses of above 100 mSv

Conclusion

- Patients with highest dose and highest # of exams are not necessarily the ones who are getting needless scans
  - The most critically ill patients
    - Trauma patients – cannot be evaluated with physical exam due to intubation and sedation
    - Cancer patients – advanced stage cancers, requiring periodic restaging CT studies or ablation studies to improve quality of life

Lessons Learned

- Track doses – without data, can't see the problems
- Appropriateness of procedure/ Mortality morbidity review
  - Good documentation necessary to determine appropriateness
- Protocol modification… and protocol **adherence**

Lessons Learned

- Who determines exam necessity?
  - Referring physician?
  - Radiologist?
- Review Implementation?
  - Requires cross-disciplinary discussion and participation
  - Participants' roles
    - Referring physician
    - Radiologists
    - Physicists
    - Administration?

Future Studies

- Focus on specific patient cohorts…
  - ED and oncologic patients – dose a priority in light of critical illness?
  - Peds
  - ED patients with minor injuries
  - Interventional patients

Thank you!
Questions…?

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