



Protocol Management and Review Strategies – The MD Anderson Experience

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Objectives

- Setting up a policy for adjustment of CT parameters on established protocols
- Setting up a policy for the development of new CT protocols
- Implementation of a CT protocol change monitoring program
- Implementation of a formal CT protocol physics review program



U.T. M.D. Anderson CT Operation

- 13 “Routine” CT scanners (GE: 4, 16, 64)
 - ~ 700 exams per day
- 3 Interventional CT scanners (Siemens)
- 5 PET/CT scanners (GE: 8, 16, 64)
- 5 SPECT/CT scanners (Siemens: 6, 16)
- 2 Research facility scanners (GE)
- 1 Educational CT scanner (GE 4)

- Total 29 CT scanners





Adjusting existing CT protocols

- Policy – appropriate representative from all of 3 groups must approve relevant changes in writing (via email)
 - Radiologist
 - Technologist
 - Physicist
- “Major” changes are phased in gradually
- Does not include minor changes such as text labeling



Creating new CT protocols

- Requires involvement of individuals from same 3 groups
- Usually trial run period performed on limited basis with close radiologist monitoring
- When final version set, introduced during regular technologist meeting by radiologist
- Phased in gradually throughout clinic



Two In-House CT Protocol Programs

- CT Protocol Parameter Monitor & Notification ©
- CT Protocol Physics Review ©



CT Protocol Monitoring Software ©

- Motivation
 - Several years ago: All protocols on one scanner were changed to much older versions overnight
 - No one confessed to doing this
- Developed program to examine CT scanner protocol files for edits made
- Program written by former GE employee now on our PACS team (Raimund Polman)



CT Protocol Monitoring Software ©

- Code: Korn-shell, Perl, html
- FTP: Binary mode
- Email: Simple Mail Transfer Protocol (SMTP)
- Chron job runs each morning



CT Protocol Monitoring Software ©

- Daily – contents of each protocol file on each GE CT scanner (18) compared to “gold standard” version for that scanner
- Any discrepancies are flagged
- Output of program emailed to physicists
- Ask lead technologist about changes
- When verified, “gold standard” version is updated



CT Protocol Monitoring Software ©

- Positive Results:
 - Quickly identify typographical errors made when making alterations to protocols
 - Quickly identify changes made without proper approvals
 - Quickly identify changes subsequent to service (when the wrong version of protocol backup is used)



CT Protocol Monitoring Software ©

- Not so Positive Results:
 - Daily chore to examine email notification
 - ANY changes are flagged, including minor alterations such as labeling
 - Frequency of protocol changes was totally unexpected
 - Several times each week parameter changes must be examined and verified



CT Protocol Physics Review ©

- Texas Dept. of State Health Services recently recommended monthly technologist CT protocol reviews be instituted.
- We have elected to make our medical physics staff responsible for this effort, at least initially, for full review of all technical and dose-related parameters.
- Estimated total of over 300 protocols to review on 26 CT scanners.
- Launched effort in January 2010.



CT Protocol Physics Review ©

- Initially recruited help of all interested staff medical physicists to undertake a formal monthly review procedure due to scope of project.
- Group decided examination of scanner parameter settings more useful than evaluating protocol summary version.
- At introductory meeting, one physicist (former GE CT employee) offered to create software to help streamline the review process.



CT Protocol Physics Review ©

- Review process somewhat scanner application dependent
 - Interventional radiology – few protocols, rarely altered.
 - SPECT/CT and PET/CT - few protocols, rarely altered.
 - Routine CT scanners – LOTS of protocols, FREQUENTLY altered.
- Initial review performed for those scanners with few protocols which are rarely altered.
- Anticipate quarterly or bi-annual reviews for these.



CT Protocol Physics Review © - Routine

- Dr. Tinsu Pan developed program swiftly that locates the protocol parameter files on a scanner and populates specific cells in a spreadsheet.
- Spreadsheet specifically designed for dose review.
- kVp, mA, rotation time, pitch, NI, beam width
- Final column shows effective mAs
 - $\text{Eff. mAs} = (\text{mA})(\text{rotation time}) / \text{pitch}$
- Simple to scan this column for initial review.



CT Protocol Physics Review © - Routine

- Protocol parameter settings retrieved remotely (desktop PC) using ftp
- Processing accomplished using Perl script for Excel format
- Program could also be run from scanner console



CT Protocol Physics Review ©

- Initial goal: all routine protocols under 400 effective mAs for 120kVp. (~300 eff mAs for 140 kVp)
- For “average” size patients.
- For TCM, evaluate max. mA settings
- Future plan: drive protocols down further (300 effective mAs for 120kvp, etc.)
- Required radiologist and technologist cooperation.



CT Protocol Physics Review ©

- Some special protocols are considered exempt from this dose limit goal.
- Large patients (DFOV > 42cm)
- Pancreatic cancer patients
 - Radiologists read sub-mm thick images as primary
 - Condition has very grim prognosis
 - Short term is critical, long term is unlikely



CT Protocol Physics Review ©

- Progress?
- Most relevant CT protocols (but not quite all) are under the initial goal limit.
- Removed many duplicate and unused protocols.
- Identified several inconsistent protocol parameter settings among identical scanners.
- Software allows single physicist to readily perform review on 13 CT scanners used for routine imaging.



What these programs can't do...

- Techs utilize protocol summary sheets
 - for reference to additional scanning details
 - for confirming technical scan parameters
- Manager insists that patients be scanned according to those summary sheets.
- Major challenge to synchronize contents of summary sheets and scanner parameters.
- Optimal: link scanner parameters directly to online protocol summary summaries...



Recommendations?

- CT vendors **MUST** consider design and implementation of similar software tools for CT facilities.
- Challenge... Computer infrastructure may be unique to each facility? How to adjust for network and email changes? How to handle scanners from different vendors?
- Somehow relevant CT protocol parameter information must be provided to local technical experts.