# *Physicist's Role in CT Protocol Review*

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# *At the beginning…*

- May need to convince administration that CT protocol review is needed
  - State regulations/recommendations
  - Recent Joint Commission document
  - (ACR CT QC Manual)
  - Fear of media reports… subsequent lawsuits…

# *MUST FORM A TEAM*

- Technologist representation
- Physicist input
- Radiologist involvement

- Do NOT try to do this alone. Bad things can happen and your credibility may suffer if there is no team behind you

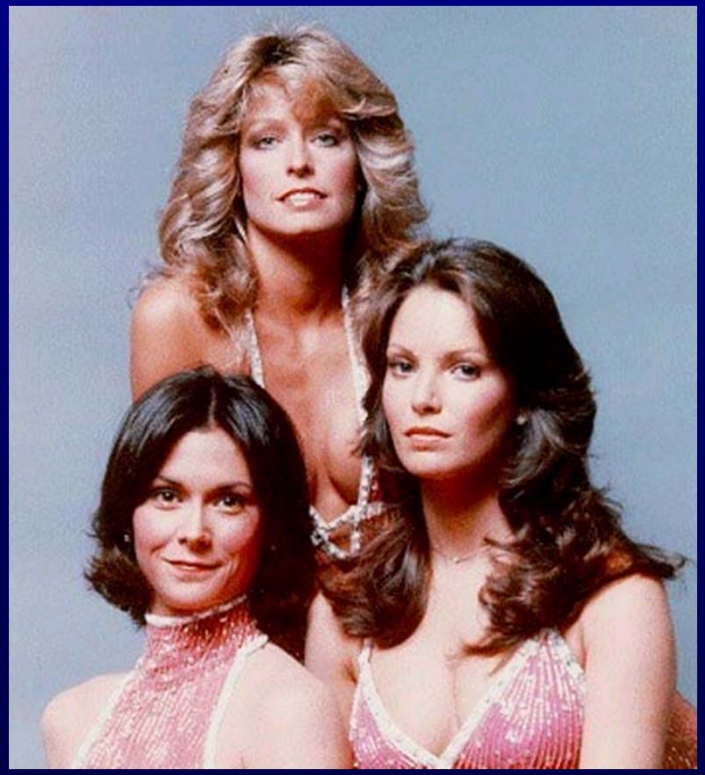
# *Getting started*

- Does the site have a protocol documentation method?
  - Binder? (hard copy)
  - Digital? (file-based)
  - Online? (easy access, quick updates)

- Does it include dose information?
  - CTDIvol
  - Range of CTDIvol?

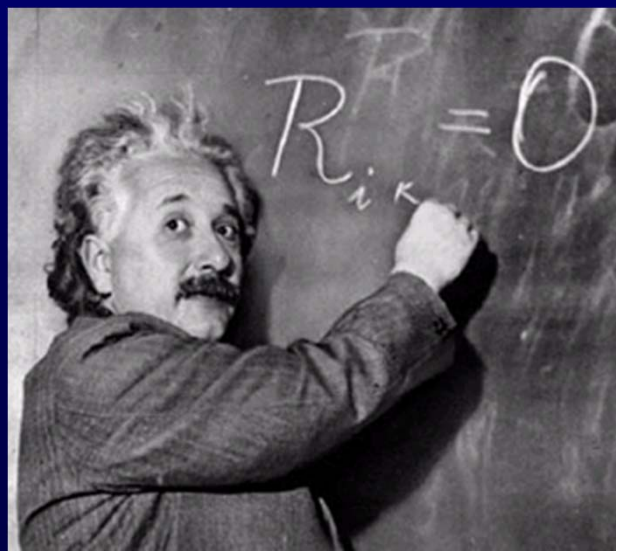
# CT Protocol Review Team

- Technologist
  - Maybe more than one
- Radiologist
  - At some point in the process
- Physicist



# *Physicist's Role*

- Best handle on image quality and dose tradeoff
- Best handle on technical parameters
- Example:
  - Dose intuition (too high, too low, about right)
  - Effective mAs
  - Change kV, how to adjust mA?
  - Change kV, how to adjust trigger HU level for contrast injection monitoring



# *More examples*

- Thick beam vs more narrow beam?
  - Thick beam -> fewer scatter tails -> more efficient
  - But extra rotations on each end of helix can cover substantial geography and deliver substantial extra exposure
  - Thin beam -> more scatter tails -> less efficient
  - But extra rotations on each end of helix will cover less geography and deliver less extra exposure
  - Cut-off point for GE ~ 25-30cm scan extent

# *And more examples*

- How to adjust parameters when patient has metal implants?
- Act as technical information conduit by communicating directly with vendor experts
- Provide Continuing Medical Education lectures when requested, especially in conjunction with implementation of new technology

# *UCLA Experience*

- Dept. chair agreed to tackle CT protocol review
  - Initial reviews were accomplished section-by-section
  - Neuro, Chest, Body, MSK, etc.
    - Chief Radiologist for section assigned to team
    - CT Tech in charge of protocol support
    - CT physicist

# *Initial process*

- EVERY protocol reviewed one at a time
- Painful
- Necessary
- Required several meeting sessions with each section chief
- Protocol signed by chief radiologist

# *MDA Experience*

- Current system at MDA not working well
- Changes to protocols near daily
- Too many to track carefully
- Need to perform regular protocol updates at remote site
- Justification for implementing a more rigorous and controlled process
- Physics pushing for overhaul of process…

# *New MDA protocol review process*

- Protocol changes to occur only twice per month
  - First & third Friday of each month
- Form required to change protocol or initiate new protocol
  - Rationale, signatures (tech/radiol/physics)
  - Launch trial run (one or two scanners), review results
  - Record date change made system-wide, date online protocol documentation changed, date remote sites updated
  - Future: make form electronic

# *New process requires*

- Meeting early each week of scheduled protocol changes
- Decide which changes to move forward
- Radiologist attendance? Signature may be sufficient
- May need emergency change route for some urgent patient care issues

- (Just getting going now – Sept. 2011)

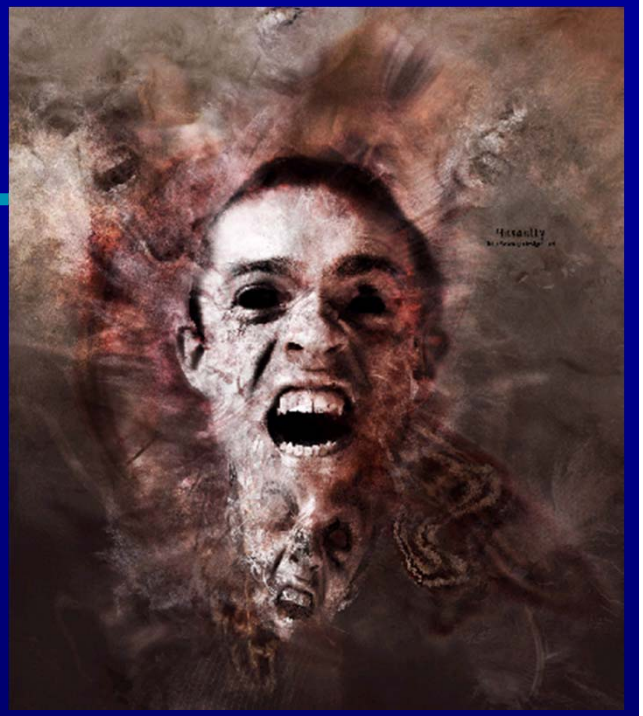
# *Big picture philosophy – Version 1*

- Few basic protocols
  - Not so many to keep track of and review
  - Require LOTS of adaptation by technologists for anything non-routine
  - Likely will result in a lot of variation in technique
  - May slow down throughput as tech makes decisions and changes
  - May work well for certain types of practice

# *Big picture philosophy – Version 2*

- Large number of protocols
  - Lots of protocols to monitor long term
  - Develop separate parameter combinations for different scanner models
  - Opportunity to optimize scanner capabilities for many different exams
  - Improve throughput
  - Improve consistency

# *Version 2 gone crazy*



- Chest without IV contrast
- Chest with IV contrast
- Chest with and without IV contrast

- Chest with and without IV contrast
  - Delete passes not ordered on the fly

# *Version 2 – turbo*

- Chest with and without IV Contrast – Feet First
- Chest with and without IV Contrast – Head First

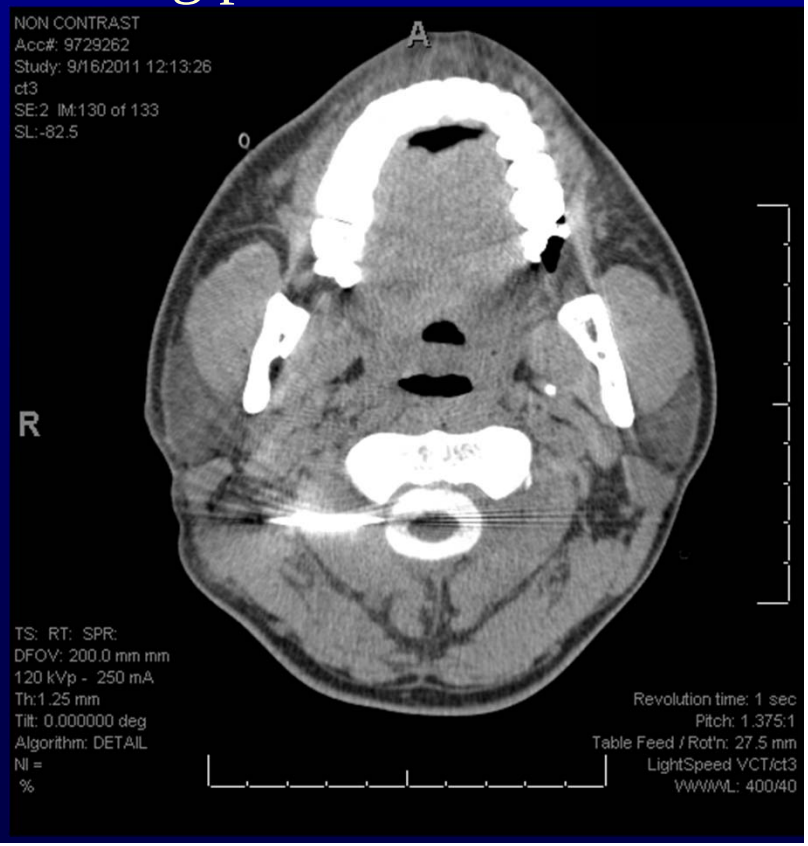
- Tube current modulation may become disabled if patient orientation is changed
- Prompted loading both head first & feet first versions for protocols employing TCM
- Vendor dependent

# *UCLA experience*

- For some protocols, reduced dose and maintained acceptable image quality
- For some protocols, **increased dose** to achieve desired image quality. Expect this to happen.
- Goal is not to expect to reduce dose for every protocol, but to balance dose and necessary image quality

# *Recent real-life MDA example*

- New protocol – spinal cord ablation
- Need to insert needle in specific place in neck
  - Staff used routine spine protocol as starting point
  - Overall pretty good, but:
    - Reconstruction algorithm not great for soft tissue
    - Large SFOV vs Head SFOV
    - 140 kVp???



# *New scanner with new features*

- Phantom scans may help to understand the effects of new technologies prior to clinical implementation
- Assist with employing new features in clinical scan protocols

# *What does the physicist do?*


- Examine dose parameters
  - CTDIvol
  - kV
  - mA, rotation time, pitch (eff. mAs)
  - Beam width, detector configuration
  - Tube current modulation parameters
    - Vary by vendor
    - Check primary (first) image thickness value
  - Target: IQ consistency for different scanner vendors & models

# *What else?*

- For aggressive (high-dose) exam, ask radiologist which parts of exam can be done at reduced settings?
  - Introduce idea of ‘dose budgeting’
  - Have target value for overall exam
  - Figure out which passes are most critical vs least critical
- Encourage enhancement delay compromise to eliminate one pass completely and avoid overlap

# *Provide Reference protocols*

- AAPM website – CT Protocols button
- Other websites (like www.ctisus.com)
- Vendor technical contacts
- Professional colleagues (swap info)