Choosing the Right Scan Parameters: Basic Scans – Neuro, MSK, Body

Dianna Cody, Ph.D.
Professor
UT MD Anderson Cancer Center
Houston, TX

- Basic CT physics principles still matter...
  - Consider lower kV when using IV contrast to boost enhancement
  - Consider more technique, iterative reconstruction, thicker images for “grainy” image complaints
  - Use faster rotation speeds to decrease patient motion
  - Lower pitch may improve IQ, but watch scan time
- Mostly recent, all real life examples of scan parameter choices
- How CT scan parameter adjustments made a noticeable improvement (and sometimes surprise problems)
- New CT protocols designed for specific purpose
Axial source images reconstructed in “Full” mode.

Longstanding reformat artifacts...

Axial source images reconstructed in “Plus” mode. Same image thickness & algorithm. No downside.

Artifacts occurred during routine brain protocol adjustment phase. Turned out to be due to a failing x-ray tube…
How to get high quality Abd/Pelvis CT images w/o IV Contrast?

- We use a specific protocol
- Labeled ‘HQ’ for high quality
- Used for patients who cannot tolerate iodine contrast
- Needed improvement for abdominal portion

Split Abd/Pelvis scan, adjusted TCM:
- Increased dose to abdominal region
- Spared dose to pelvis region

HQ pre change
461 mA
Abd pelv

HQ post change
477 mA
Split

HQ pre change
385 mA
Abd/Pelvis

HQ post change
153 mA
Split
Dose Reports – Before & After Change

- Splitting acquisitions – impact reformatted views???

Patient Care/Convenience Issue

- LARGE Lymphoma clinic
- Most frequently ordered exams (@ ~ 3 month intervals)
- Chest-Abd-Pelvis AND Head/Neck CT exams
- Previously performed on separate dates
- To improve patient satisfaction…
  - Combined into single CAP+H/N CT exam
  - Use single bolus of IV contrast
  - Localizer with Arms down (for H/N)
  - Localizer with Arms up (for CAP)
  - Scan CAP first
  - 20 sec intermission – Tech dashes into room, pt lowers arms
  - Head/Neck scan performed

Xinming Liu, Ph.D. & Rick Layman Ph.D.
Biggest Challenge???

- No place for arms/hands to rest if using head-holder
- Forced to scan patient on table-top
- Causes artifacts on both GE & Siemens head images

Decrease cardiac motion, please…

0.5 sec rot time
Siemens Force

0.285 rot time
Siemens Flash

Xinming Liu, Ph.D. & Rick Layman Ph.D.
Before change

After change, new problem

Undersampling??

Danger of artifacts...

New CT Protocol – MSK Example

Remove bone at pink lines – then, what???

Bone filler necessary

• Patient’s own bone tissue is best option (no rejection issues)
• Which bones would be reasonable to harvest?
  • Fibula (lower leg)
  • Ulna (lower arm)
• Critical to success – maintaining blood supply to bone tissue

SmartPrep Descending Aorta:
Reached 100 HU
20 sec Arterial (5 sec scan)
24 sec Venous (5 sec scan)
31 sec Delay (5 sec scan)
Ulnar ‘Flap’ – bone plus vasculature

Surgical planning –
• Which vessels?
• Where are they?
• How to harvest them intact?

Tricky part – delay time between IV contrast & scan. Need time for contrast to fill these tiny vessels…

AAPM website –
• Basic exam scan parameter sets
• Multiple vendors & scanner models

Don’t expect 100% perfection
• Some patients have specific challenges
• Some protocols run opposite to scanner design
• There will always be less than pretty CT exams
• Diagnostic?

Struggle – Radiologists’ “confidence”
• Fear missing subtle finding
• Increasing interpretation speed pressure

Open Faculty Position – Assistant Professor
University of Texas MD Anderson Cancer Center

• Houston, TX
• ENORMOUS equipment base
• Competitive salary
• Excellent benefits
• Ph.D. (D.M.P.)

• Some flexibility –
  – Focus area of interest
  – Keep broad expertise
• X-ray based modalities
• Academic environment
• Imaging Physics Dept. (>100)

Contact: dcody@mdanderson.org