Clinically Focused Physics Education: Principles to Practice Part B

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Why teach at the viewbox?

Practical trou lity and dose

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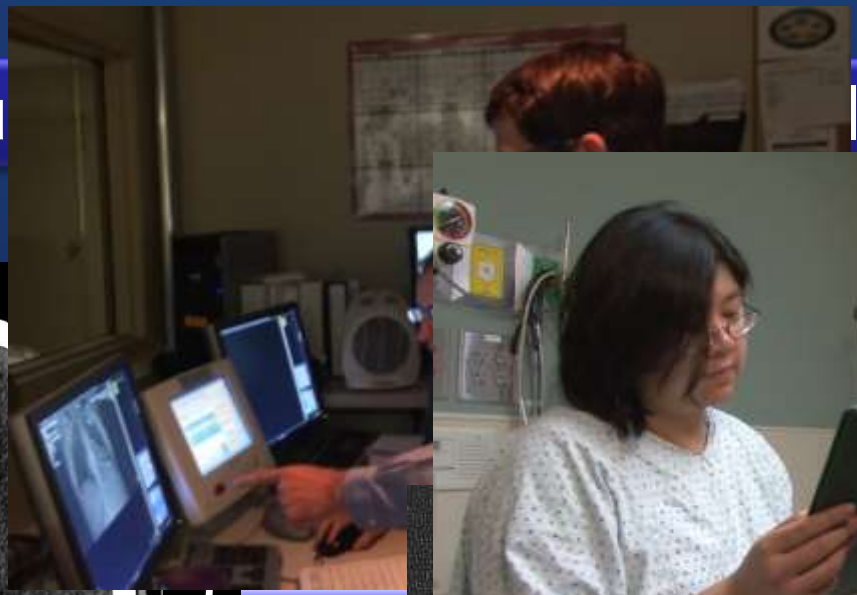
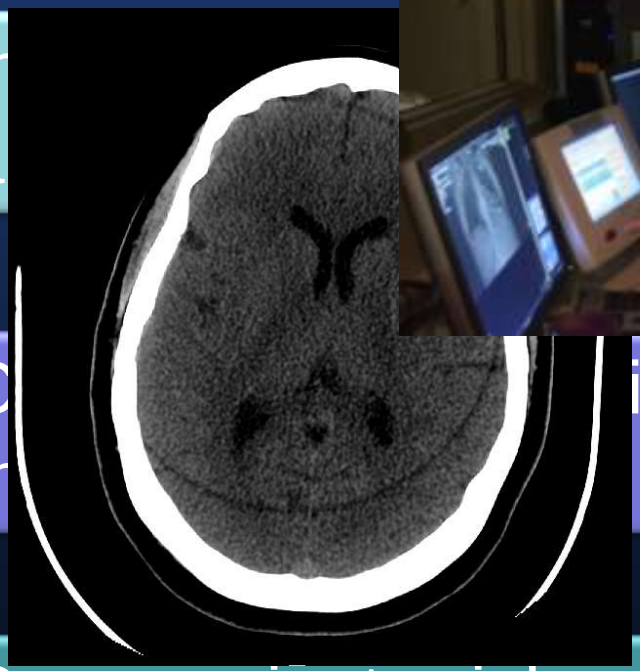
Communicate risks and b
and other healthcare wor

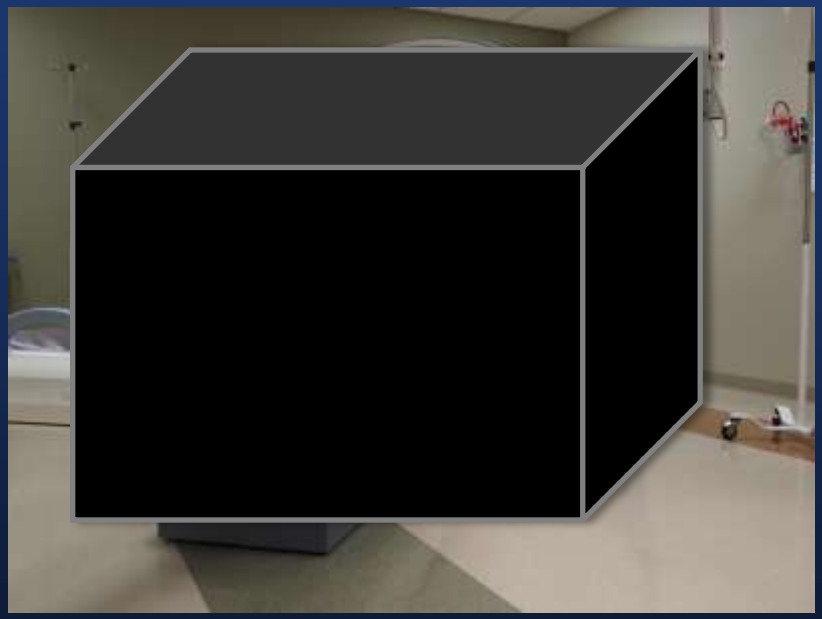




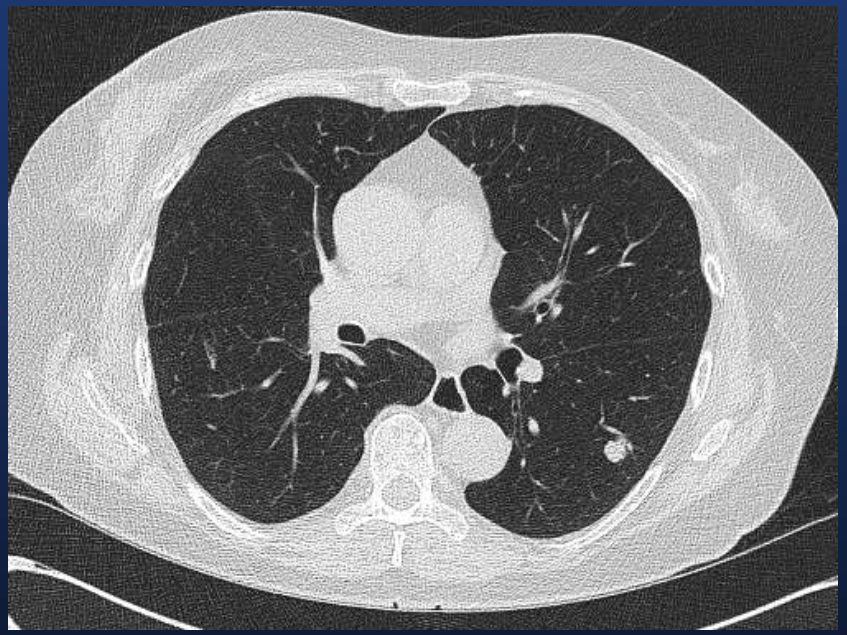
Scanners are complex

Multidetector CT

Iterative recon



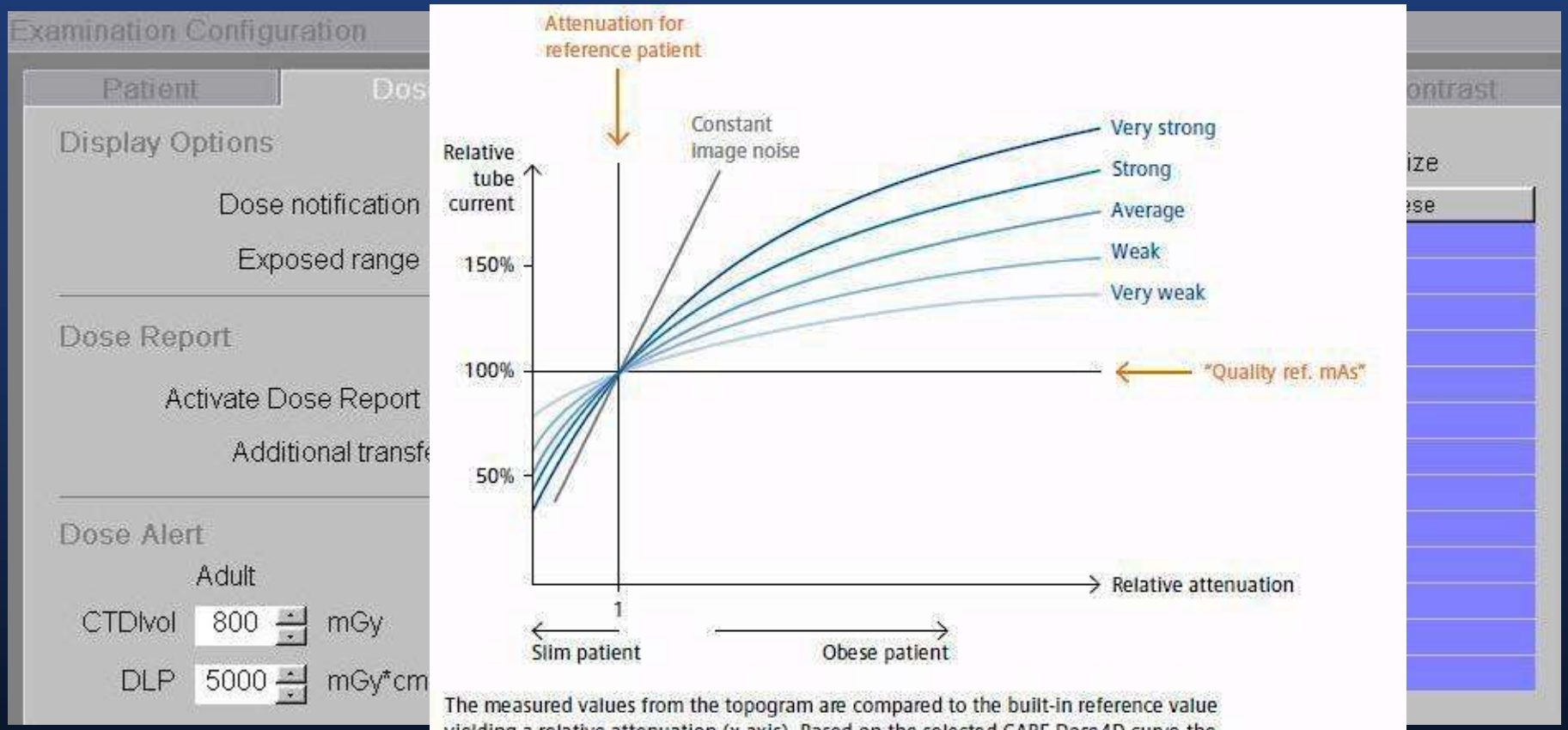
Image



ATCM

autokV

Scanners are very complex



Siemens

More good reasons…

Joint Commission requirement for dose to be part of medical record starting July 2015(?)

Patient access to reports via patient portal

Non-interpretive skills section on ABR exam

How we do it

- Assign articles to read
- Learning modules:
  - http://www.sprawls.org/resources/
  - Communicating risks and benefits with patients (soon to be medU Core module)
    - Case-based online module—see our educational exhibit
    - Risk communication concepts

Review at the Viewbox

- Discuss dose report
- Discuss protocol parameters that affect dose and quality
- Dose reduction techniques and pitfalls
- Review proper patient positioning

Review dose report

Exam Description: CT Head w/o Contrast

Dose Report

Series	Type	Scan Range (mm)	CTDIvol (mGy)	DLP (mGy-cm)	Phantom cm
1	Scout	-	-	-	-
2	Axial	I185.500-I30.500	19.79	316.70	Body 32
			Total Exam DLP:	316.70	

1/1

a.

Exam Description: CT Head w/o Contrast

Dose Report

Series	Type	Scan Range (mm)	CTDIvol (mGy)	DLP (mGy-cm)	Phantom cm
1	Scout	-	-	-	-
2	Axial	I178.750-I20.285	48.82	798.53	Head 16
4	Axial	I178.750-I102.075	48.82	399.27	Head 16
			Total Exam DLP:	1197.80	

1/1

b.

Duong PA, Little BP. Dose tracking and dose auditing in a comprehensive computed tomography dose reduction program. Semin Ultrasound CT MR; 35(4): 322-330

Only 1 set of images on PACS

Exam Description: CT Abdomen + Pelvis w/

Dose Report

Series	Type	Scan Range (mm)	CTDIvol (mGy)	DLP (mGy-cm)	Phantom cm
1	Scout	-	-	-	-
2	Helical	S112.500-I557.500	21.82	1563.05	Body 32
6	Helical	S148.000-I567.000	21.49	1636.17	Body 32
			Total Exam DLP:	3199.22	

Patient scanned twice but only 1 set of images sent!

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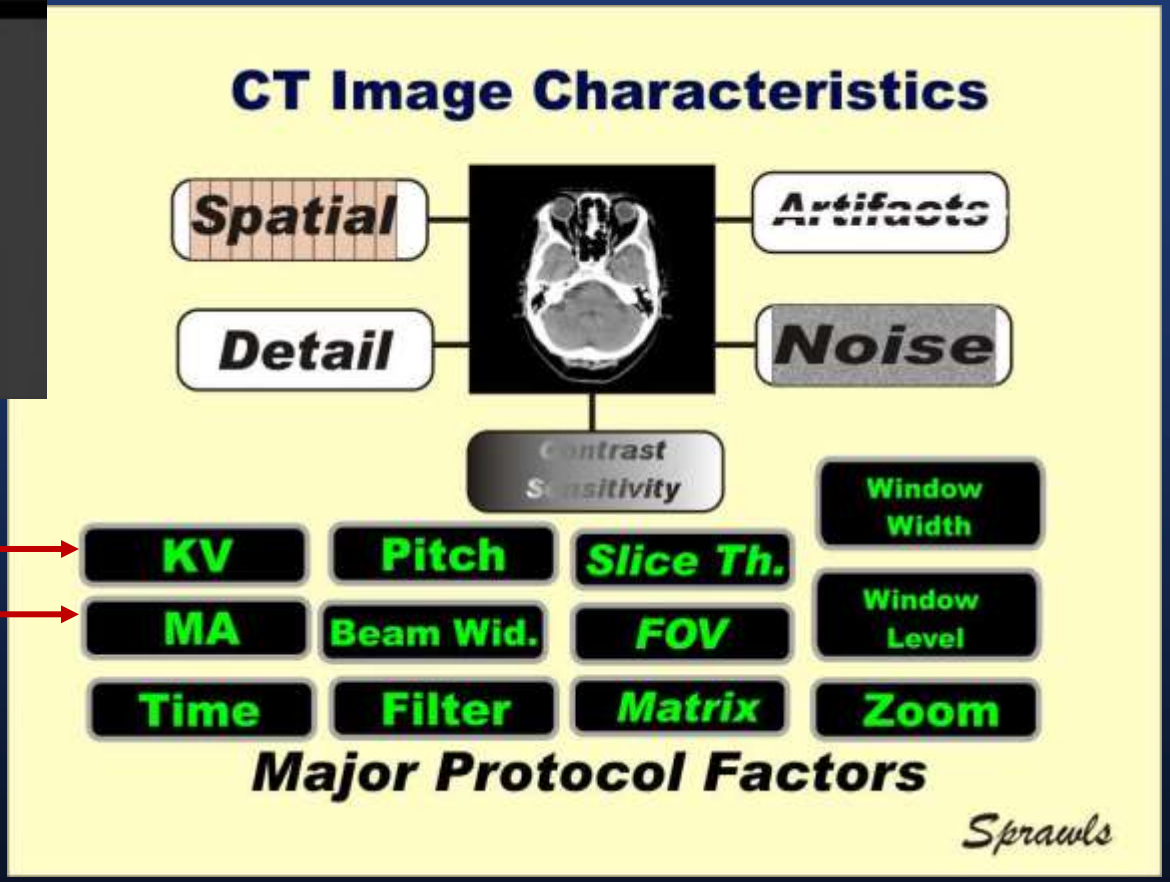
Protocol factors

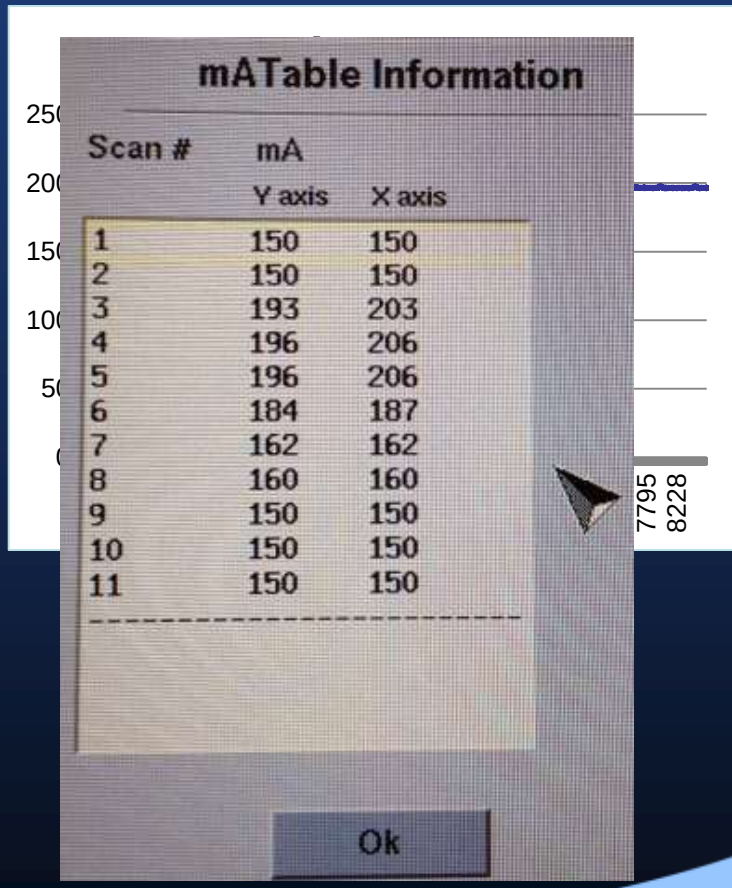
Automatic selection based on scout



Beware of pitfalls!

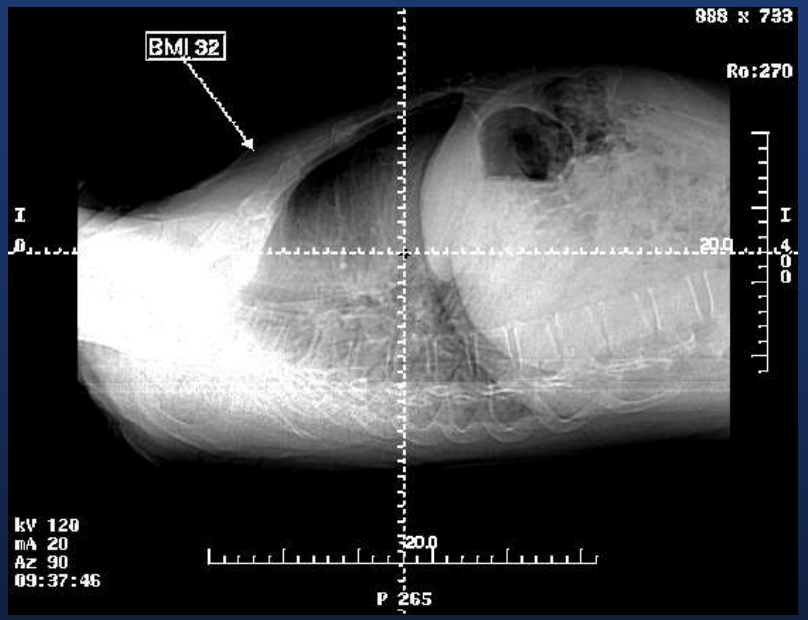
Automatic tube current modulation (ATCM)

- X-Y axis
- How modulates depends on manufacturer
  - Sinusoidal (GE)
  - Attenuation based (Phillips, Siemens)
- Curves not available to user



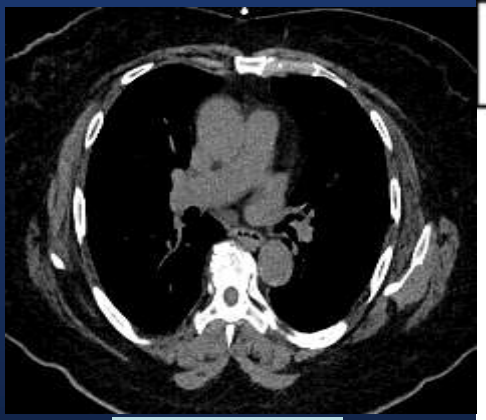
Miscentering increases dose

- 549 patient scouts
  - Mean error: 2.3 cm below center of rotation
  - Mean increase in noise 7%
  - Mean increase in surface dose 15% (up to140%)

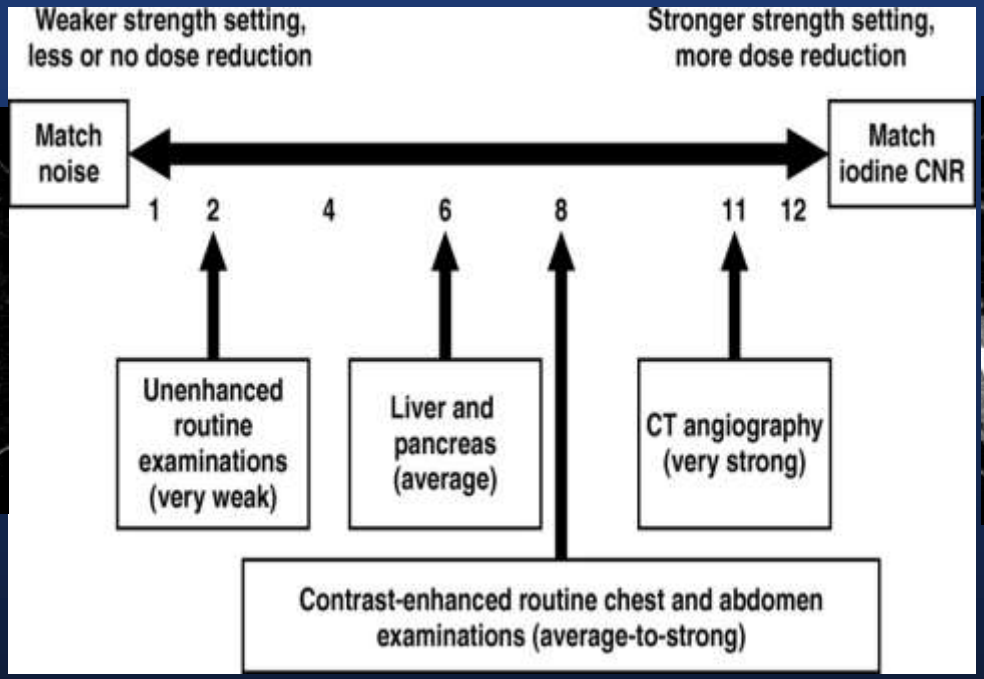


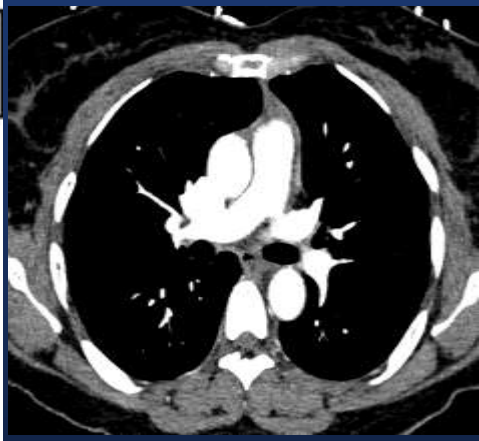
-Toth T, Ge Z, Daly M. *Med Phys. 2007* Jul; 34 (7):3093-101

Automatic Tube Potential Modulation (ATPM)



140 kVp
259 mAs

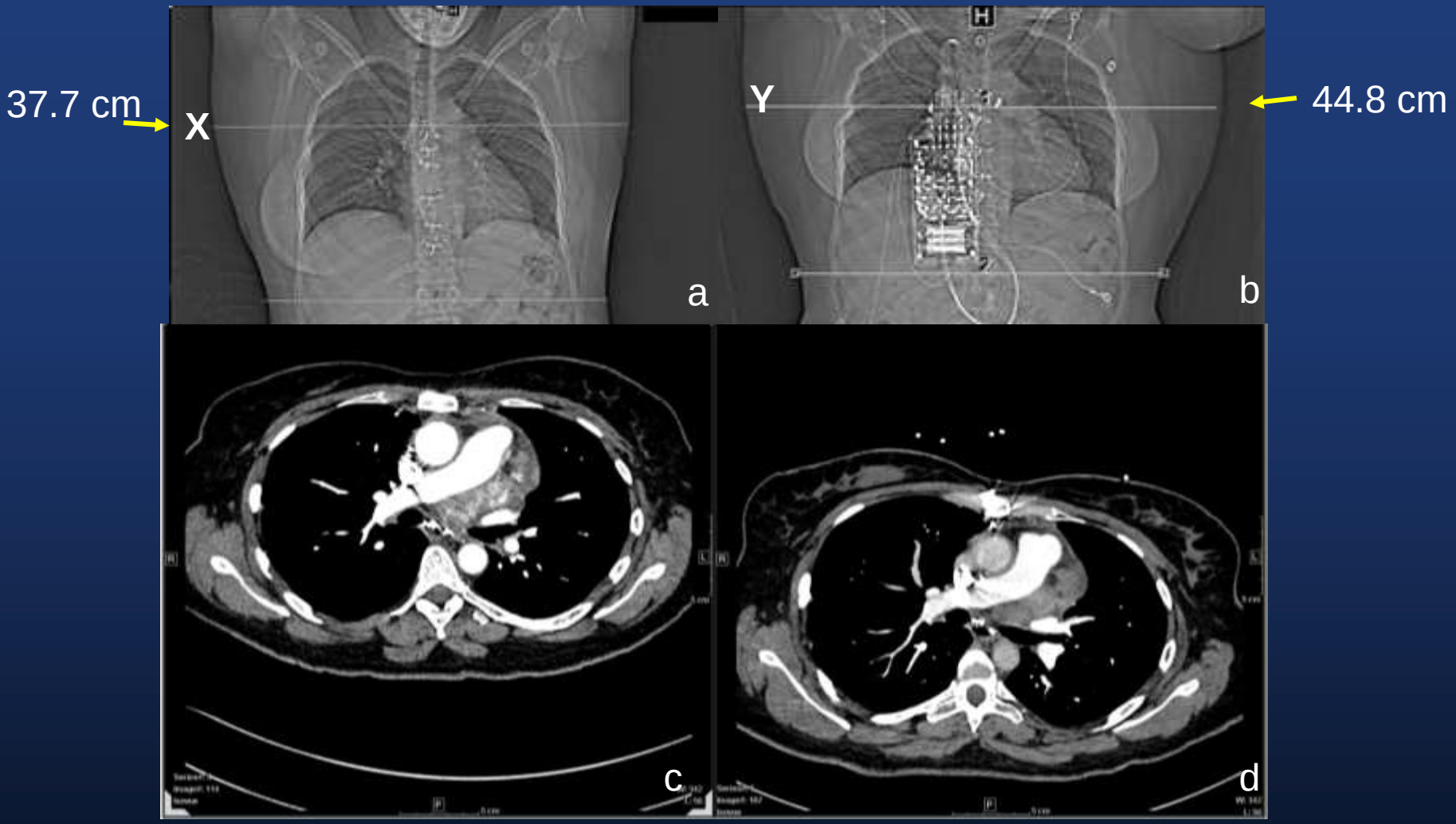




100 kVp
212 mAs

Yu L, et al. *AJR.* 2013 Aug; 201(2):W297-306

Works in concert with automatic tube current modulation.



CTDIvol: 6.6 mGy/cm

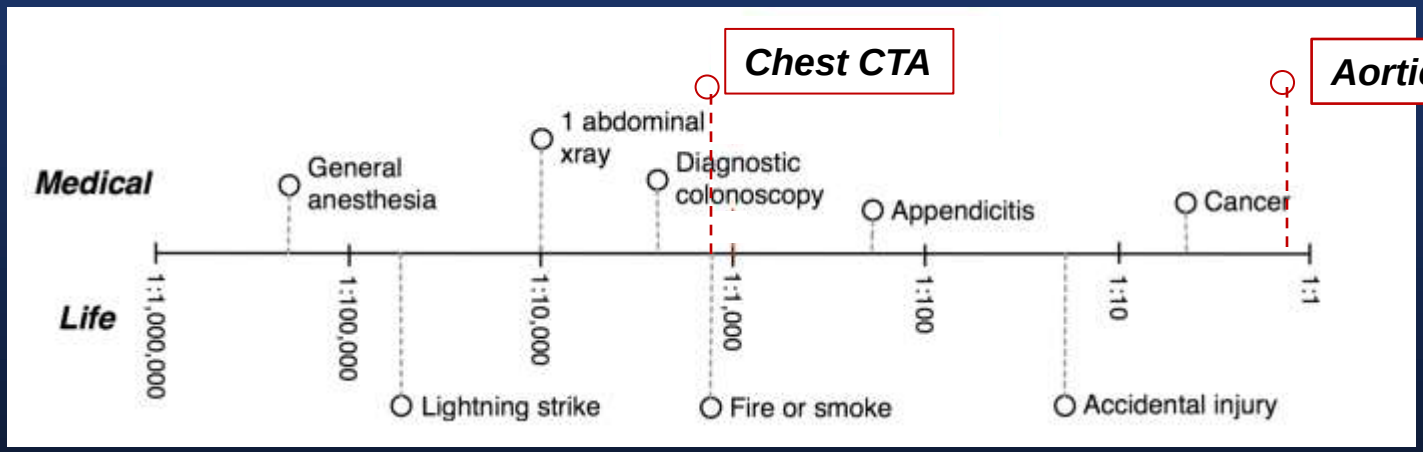
CTDIvol: 20.28 mGy/cm

Communicating with patients and other healthcare workers

- Visual aids for patients
- Natural frequency (“1 in 1000”)
- Online resources:
  - Xrayrisk.com—calculate estimated
  - Radiologyinfo.org
  - Riskcomm.com

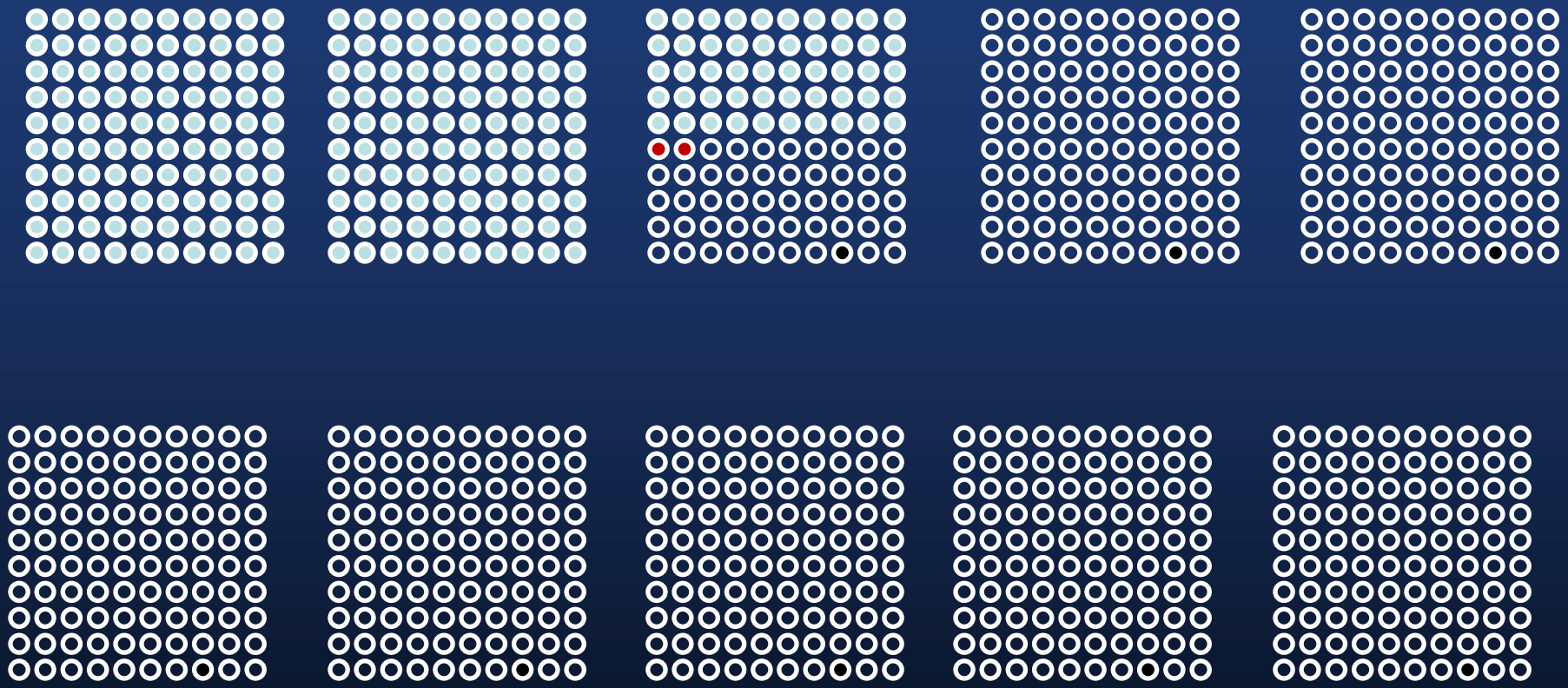
How do I present the risks to the patient?

One way to discuss risk is to use a perspective scale showing the relative risk of death to other life risks.

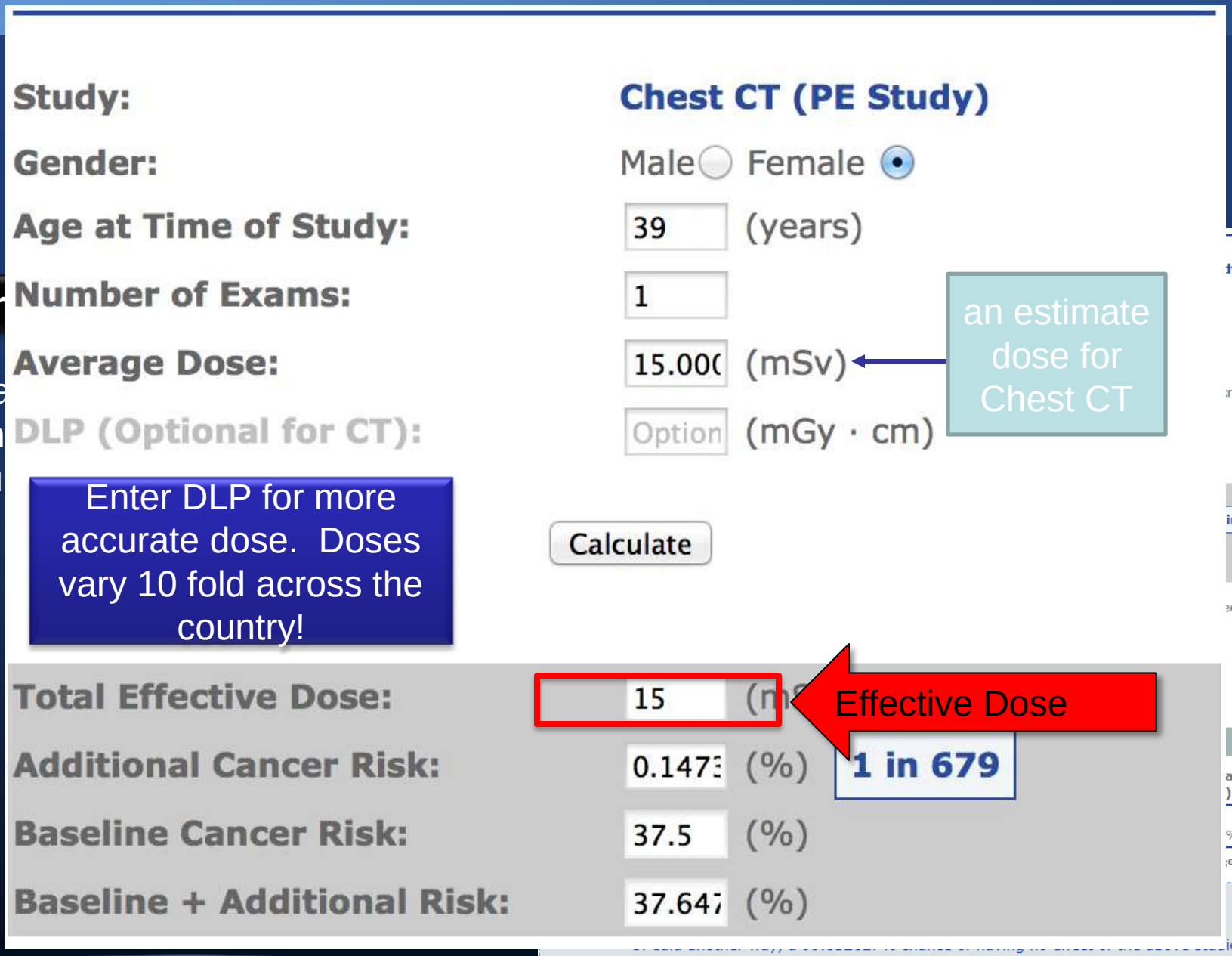


Blank scales can be found at http://www.riskcomm.com/scales.htm

Estimated Cancer Risk for Multiphase Chest CTA



- Lifetime risk of cancer
- Additional risk of a multiphase chest CTA

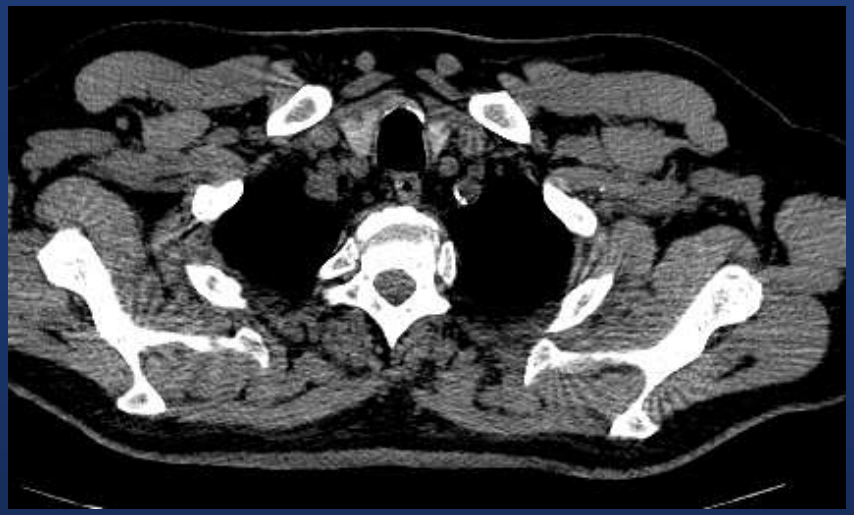


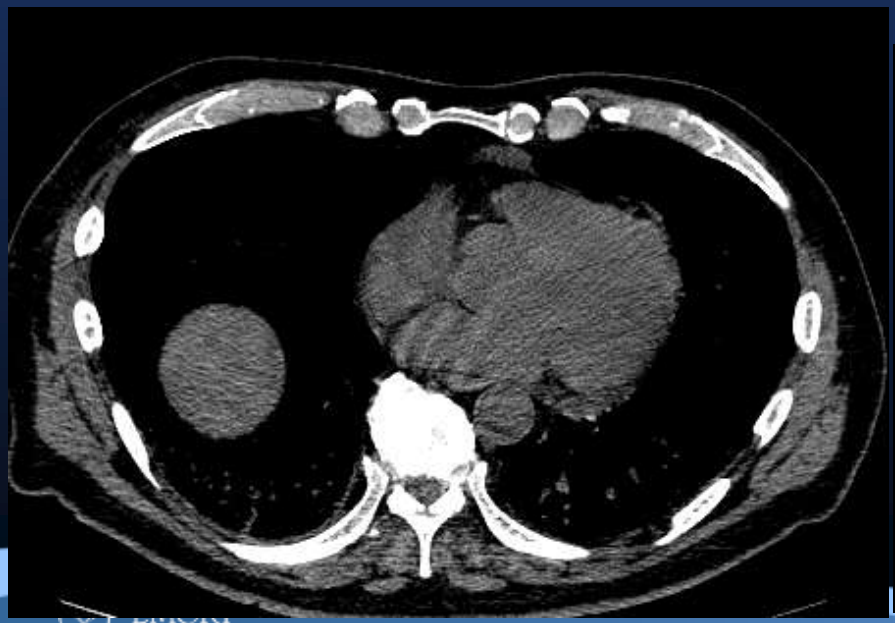
Case based review

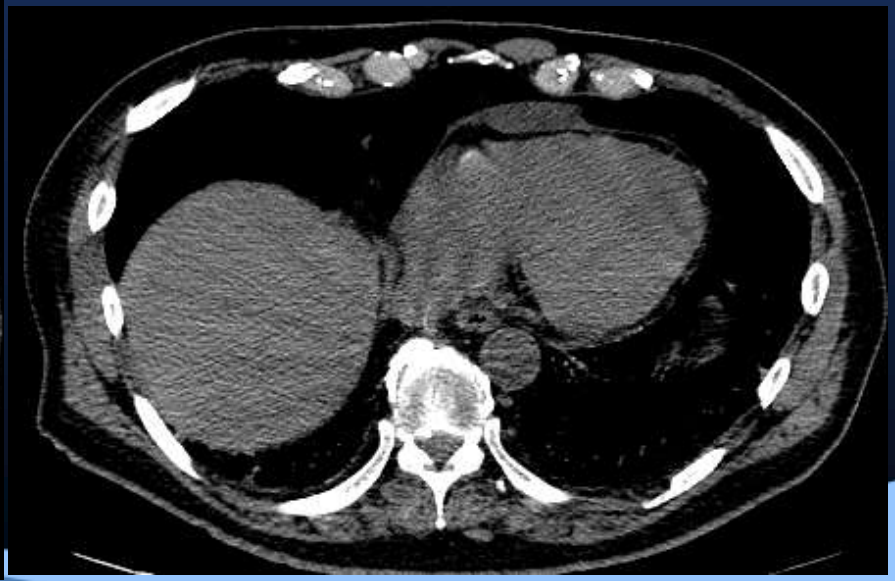
- Artifacts
- How to decide among dose reduction options
- What's wrong with this picture?

Sample cases

Helical “windmill” artifact







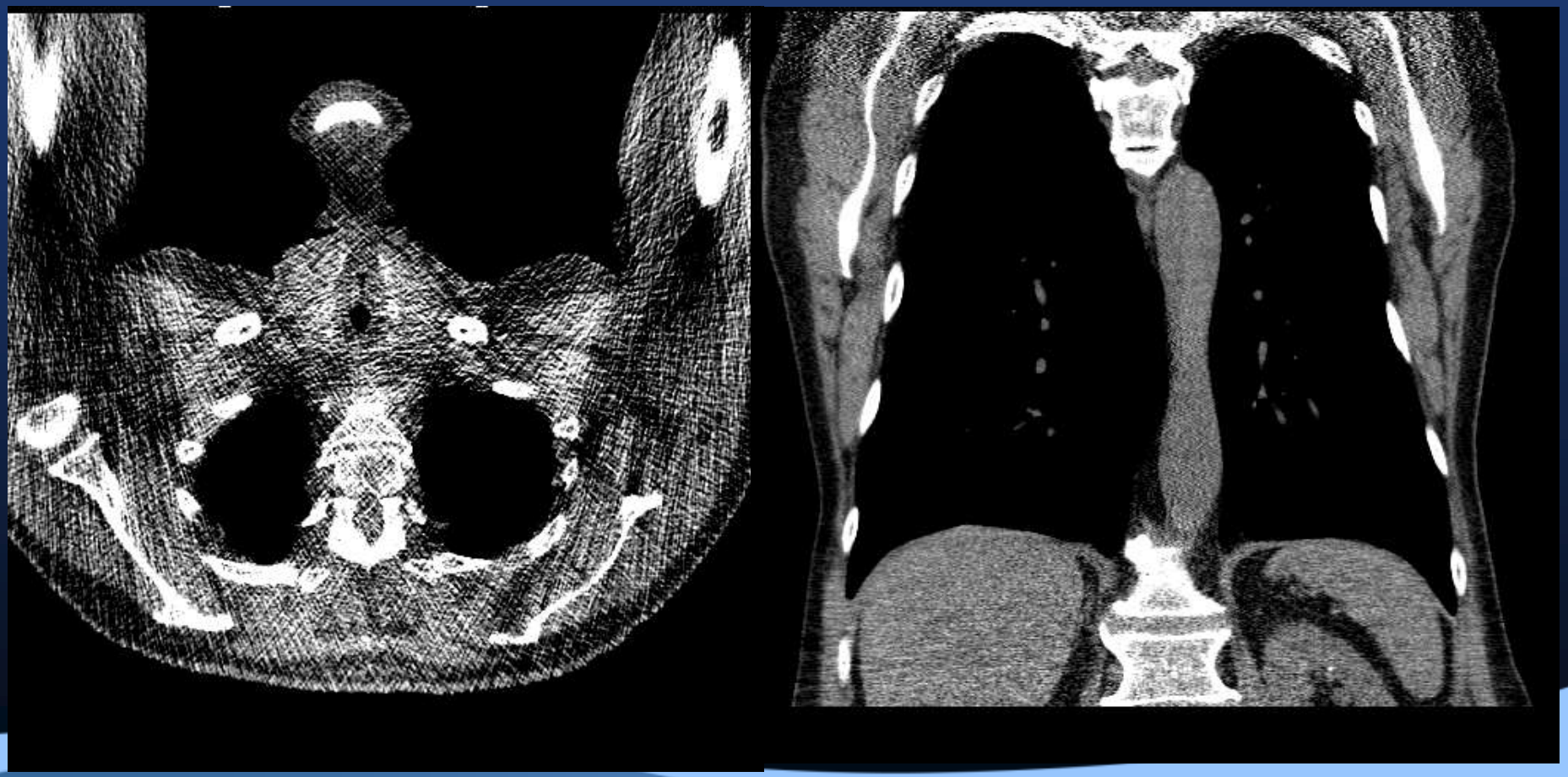
Helical artifact

- High effective pitch
- Discuss effective pitch
  - When does it need to be less than 1?
  - What are the advantages and disadvantages of a high pitch?

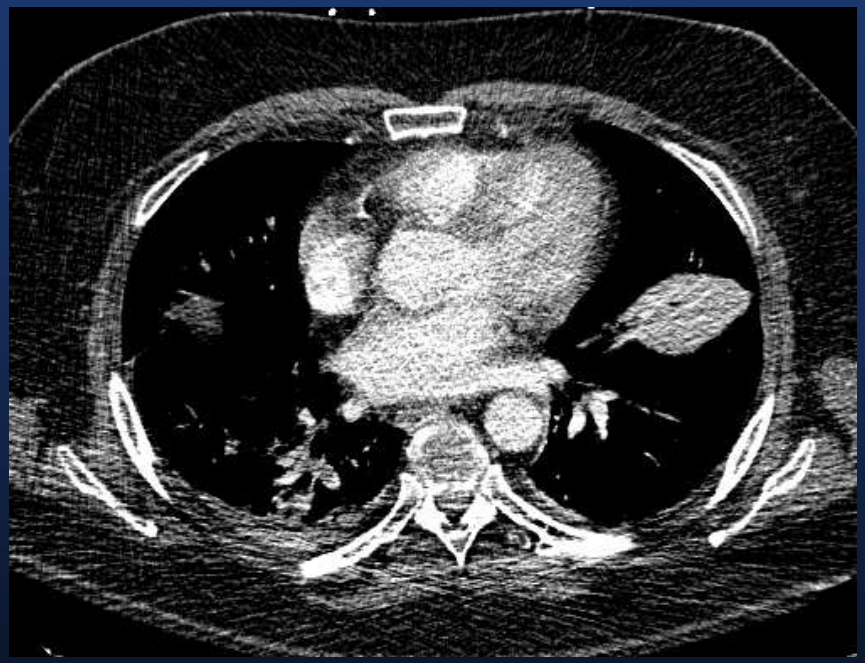
Scanner artifacts: ring artifact

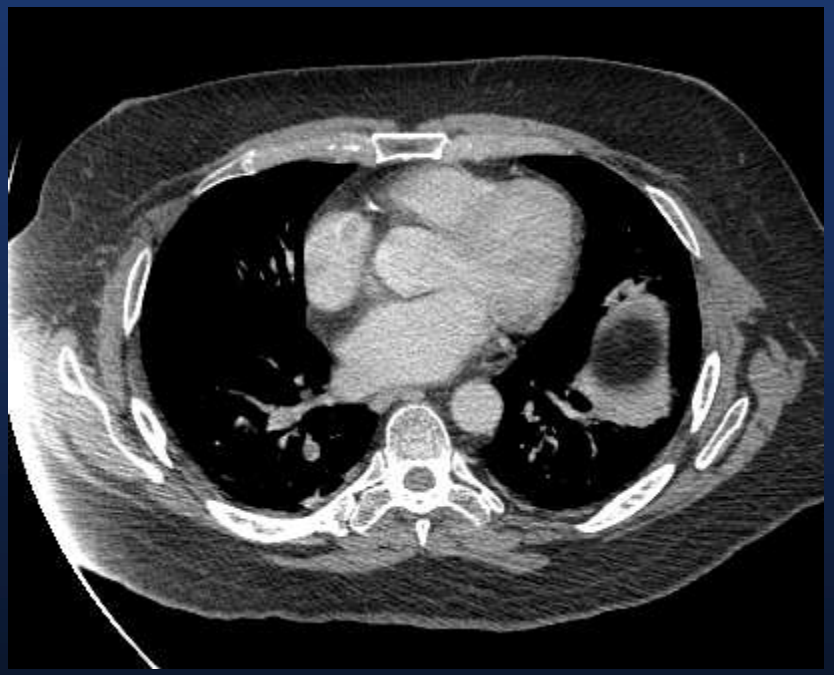
- Detector out of calibration
  - Can recalibrate
  - Discuss QC procedures

Photon starvation—no dose modulation



What's wrong with this picture?



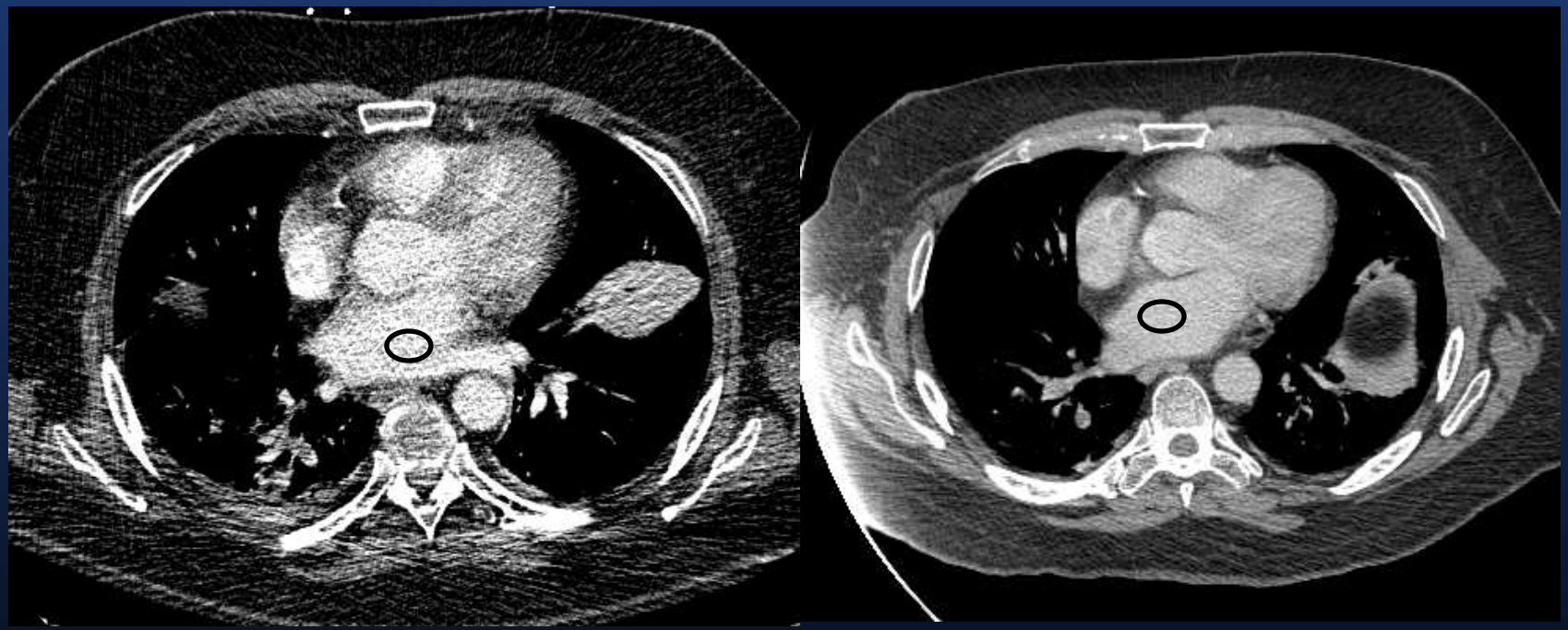


kVp: use 100kv bmi<30 only!

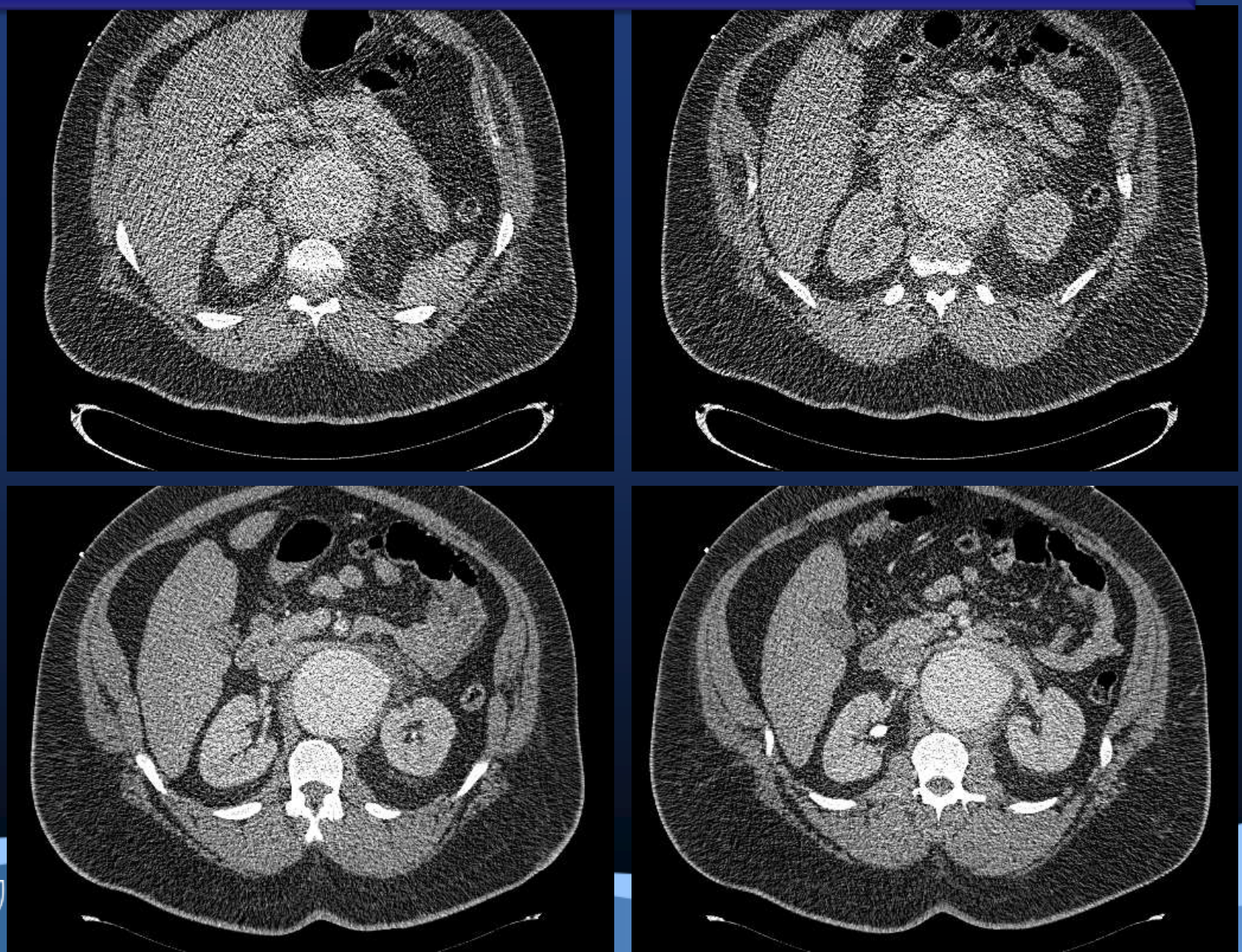
BMI = 39

kVp = 100, noise(SD) = 68

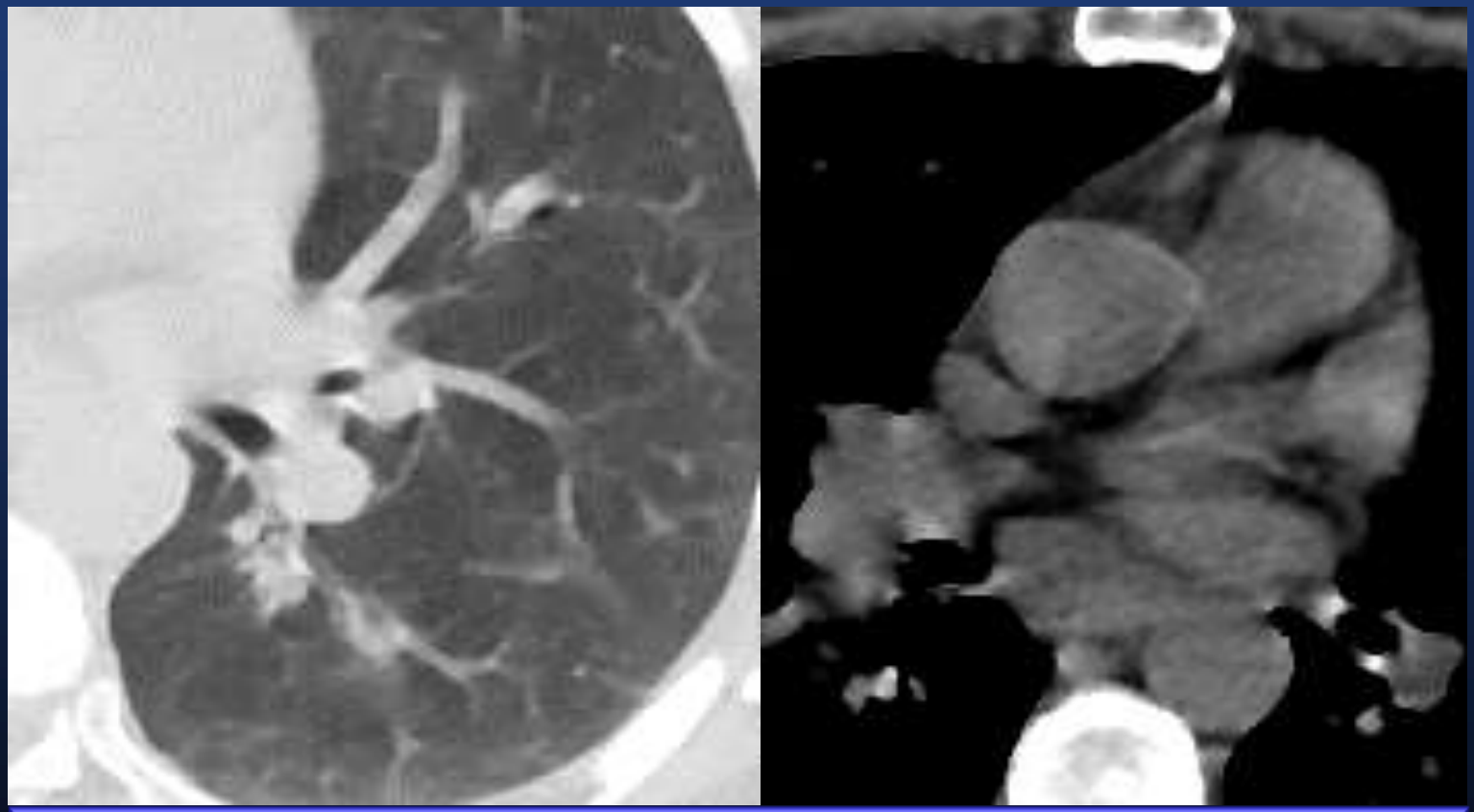
kVp = 120, noise = 26



No ATCM, fixed mode with low mA



What's wrong with this picture?



Iterative reconstruction—too many iterations (100% ASIR)

Case based scenarios

- What is the best dose reduction strategy?

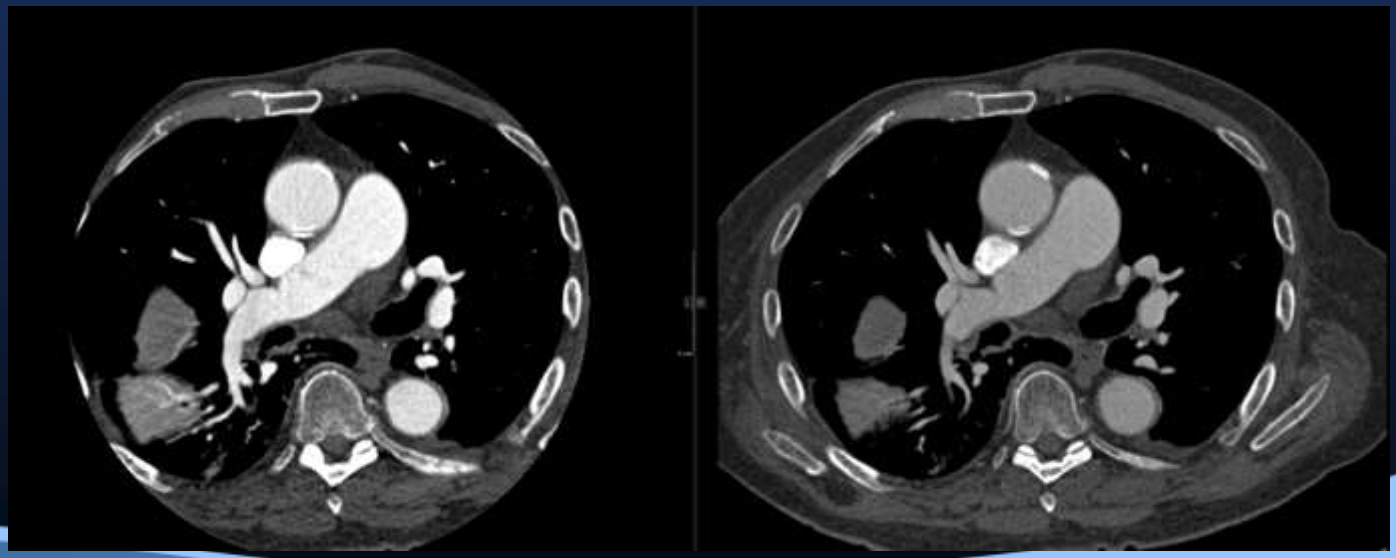
Thin woman, 64 row MDCT, CTA CAP(Aorta)

A. Increase noise index (lower quality index)

B. Decrease kVp

C. Increase pitch

Answer: B

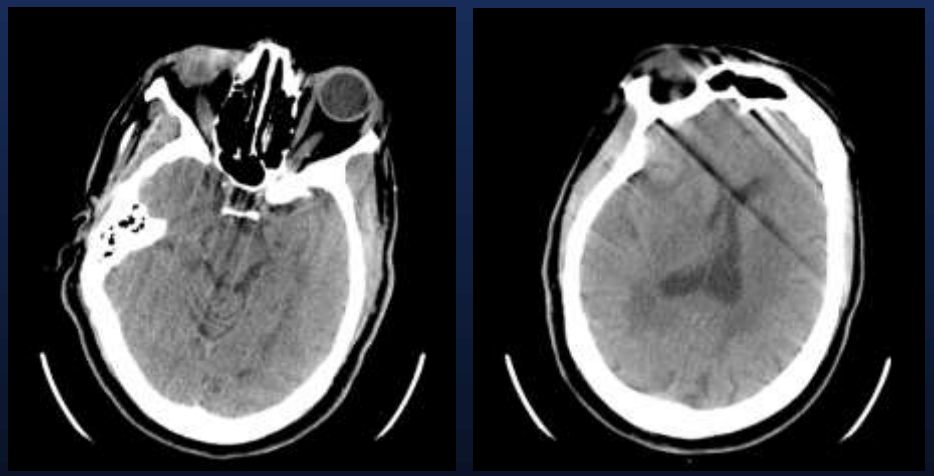


100 kV 120kV

Head CT on uncooperative inpatient

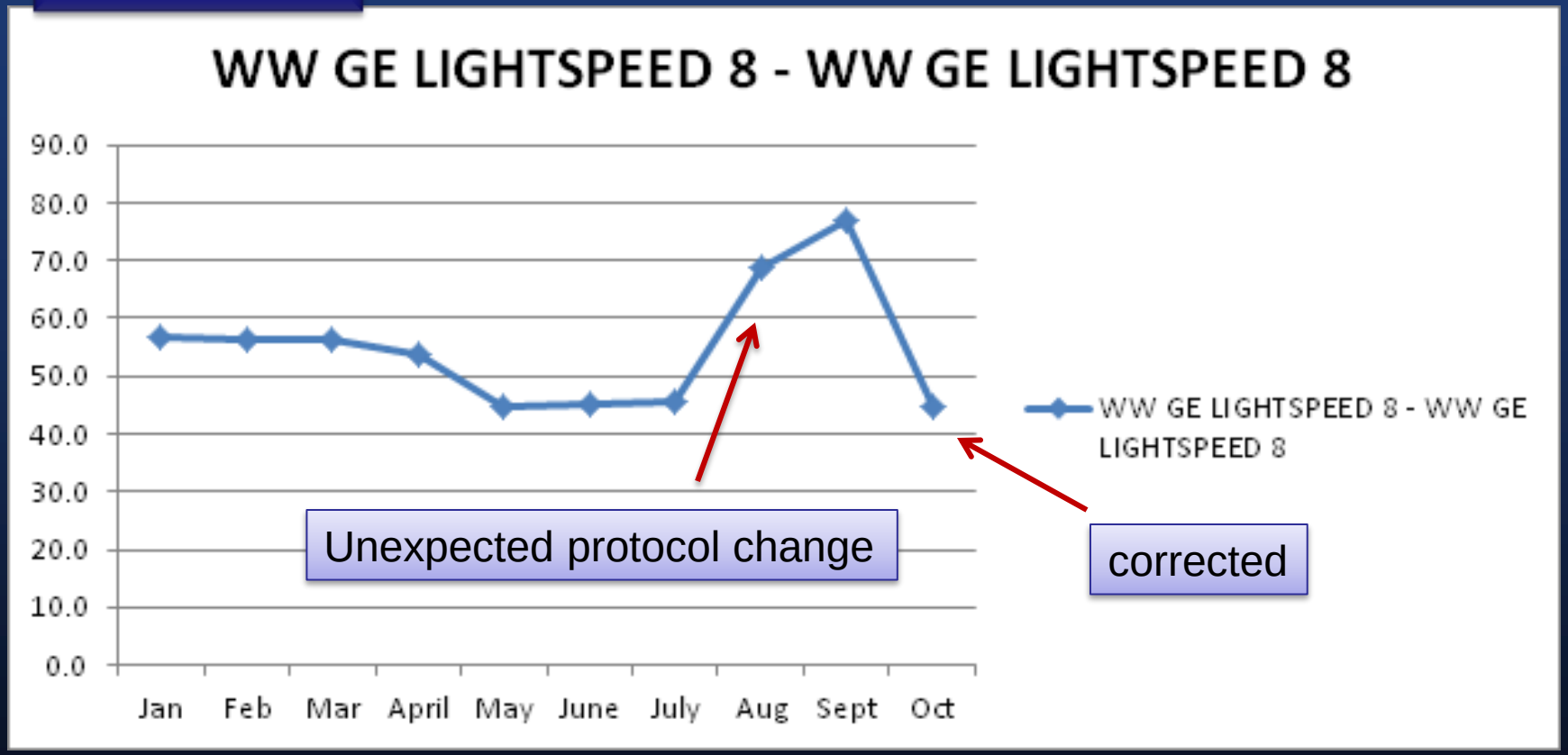
- A. Helical mode, large collimation
- B. Axial mode, small collimation

- Answer: A



Dose tracking

CTDI head CT



Summary

Engage residents in learning about image acquisition, safety, and quality

Improve communication with patients and other health care professionals