Optimizing Bone CT: General

There are always 3 things technologists can do to optimize Bone CT

1) Optimize Patient Positioning
- ✓Try to center the bone
- ✓Get other bones/metal out of scanning FOV

2) Optimize Scanning Technique
- ✓Thin slices, 50% overlap
- ✓Use small focal spot, small display FOV

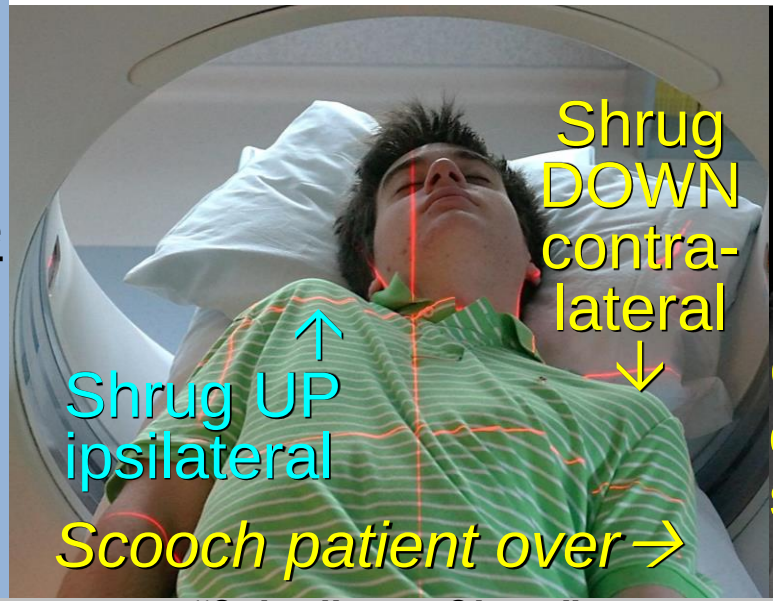
3) Optimize Reformats
- ✓2D: Angle slices relative to ANATOMY
- ✓3D: Rotate & Segment

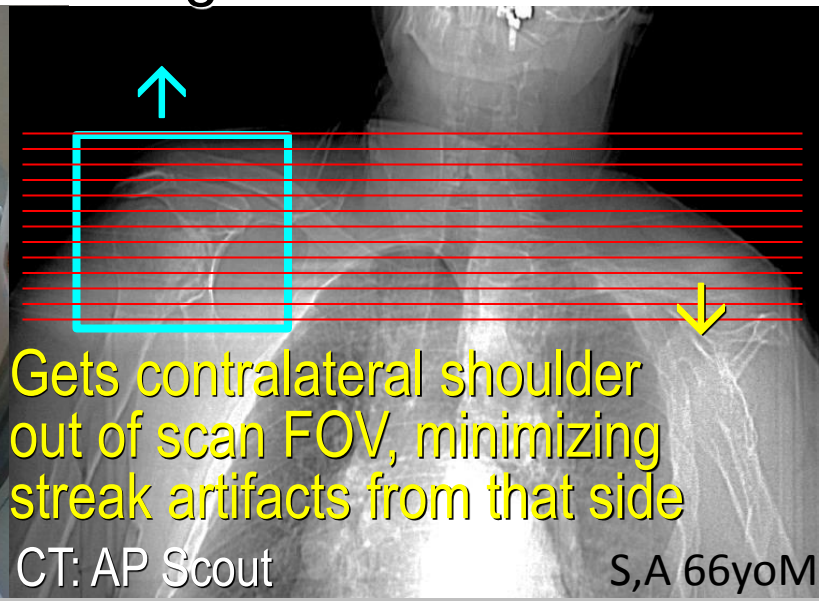
Optimizing Bone CT: Shoulder

1) Optimize Patient Positioning

✓Try to center the bone ← ***This depends on body habitus***

✓Get other bones out of scanning FOV ← ***This does not***





"Schreibman Shrug"

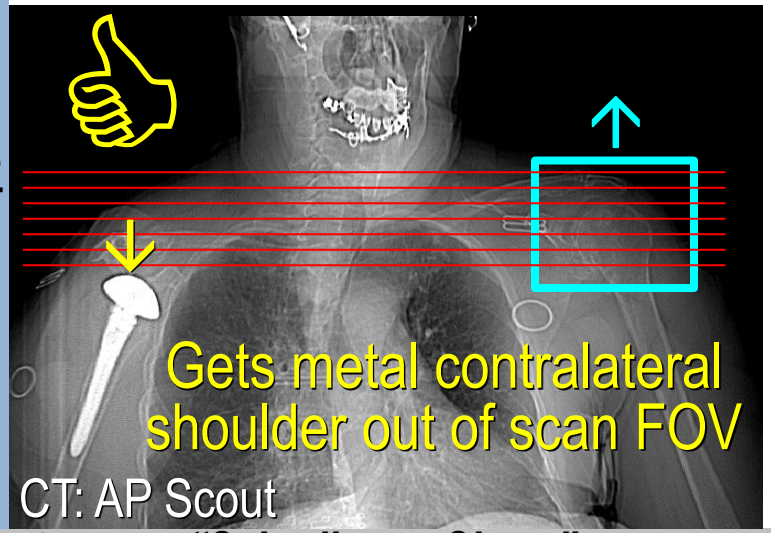
Optimizing Bone CT: Shoulder

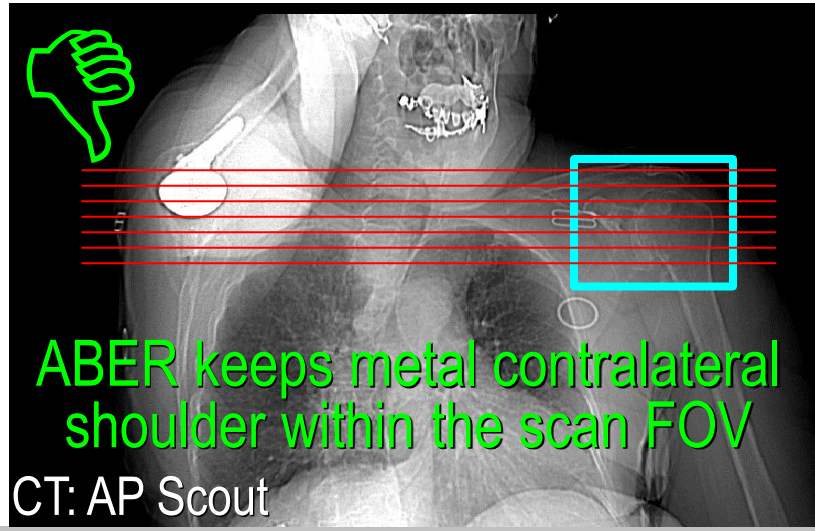
1) Optimize Patient Positioning

✓Try to center the bone ← ***This depends on body habitus***

✓Get other bones out of scanning FOV ← ***This does not***

✓**GET METAL OUT OF SCANNING FOV!**





"Schreibman Shrug"

C,B 83yoF

Optimizing Bone CT: General

2) Optimize Scanning Technique

(This is what my physicist tells me..)

a) Use Small Focal Spot

- Cannot manually select small focal spot
- Small focal spot comes on automatically if the mA<particular value, based upon the kV
  - ✓Ask your Application person for your CT scanner
- Can use Automatic Exposure Control (AEC)
  - ✓Set the Max mA value to be less than the maximum allowed mA for the small focal spot

GE CT Scanner mA Limits

Scanner Name	Scan FOV	140 kV	120 kV	100 kV	80 kV
Discovery CT750HD	Normal mode: Large Focal Spot	715	835	800	700
	Hi Res mode: Large Focal Spot	540	625	750	700
	Normal mode: Small Focal Spot	10 - 490	10 - 570	10 - 680	10 - 620
	Hi Res mode: Small Focal Spot	10 - 360	10 - 420	10 - 500	10 - 620
LightSpeed VCT 64, LightSpeed 16 Pro, & Optima CT 580	Large Focal Spot	715	800	770	675
	Small Focal Spot	10 - 335	10 - 335	10 - 310	10 - 300
Revolution Evo & Optima CT660	Large Focal Spot	515	560	480	400
	Small Focal Spot	10 - 170	10 - 200	10 - 240	10 - 300
LightSpeed 16, & LightSpeed 8	Large Focal Spot	380	440	420	400
	Small Focal Spot	10 - 170	10 - 200	10 - 240	10 - 300

What kV to use?

- Adults:
  - ✓ **At least 120**
- Large Adults:
  - ✓ **Use 140**
- Small child:
  - ✓ **Use 100**

Courtesy of Frank Ranallo, PhD, DABR
Physicist- UW Radiology Department

Optimizing Bone CT: General

2) Optimize Scanning Technique

(This is what my physicist tells me..)

b) Thin slices with 50% overlap

- Shoulder: Thin but not too thin (1-1.5mm)
  - ✓<1mm slices may be too noisy (We use 1.25mm)
- 50% overlap yields better reformats
  - ✓Adds information to the stack of axial images
- Pitch close to 0.5
  - ✓Reduces helical artifacts
  - ✓Uses less mA, hence use small focal spot

Optimizing Bone CT: General

2) Optimize Scanning Technique
(This is what my physicist tells me..)

c) Use smallest possible display FOV to maximize resolution

- Display FOV always = 512 pixels
- ↓Display FOV → smaller pixel size
- Smaller pixel size → higher resolution

Just a little math…

50cm display FOV / 512 pixels → pixel size ≈ 1 mm

25cm display FOV / 512 pixels → pixel size ≈ ½mm

Optimizing Bone CT: Shoulder

2) Optimize Scanning Technique

(This is what my physicist tells me..)

d) Use "Ultra High Resolution" (UHR)…

…if available on your CT scanner

- On any CT scanner, resolution degrades dramatically as you move away from center
  - ✓***This will always be an issue with shoulders***
- Hi Res uses fluctuating focal spot position
  - ✓Minimizes off-center sharpness degradation
  - ✓***Particularly useful for shoulders***

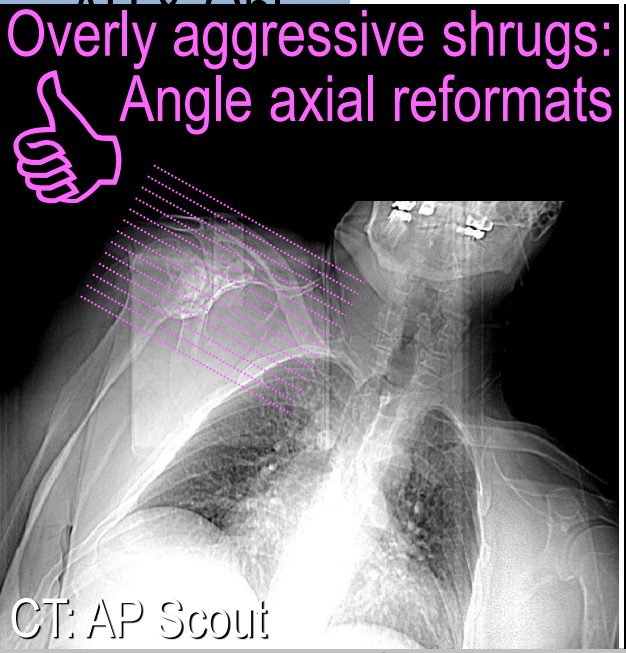
Optimizing Bone CT: Shoulder

Bones Ⓢ Ⓒ Ⓗ
Radiographs
AP & Oh

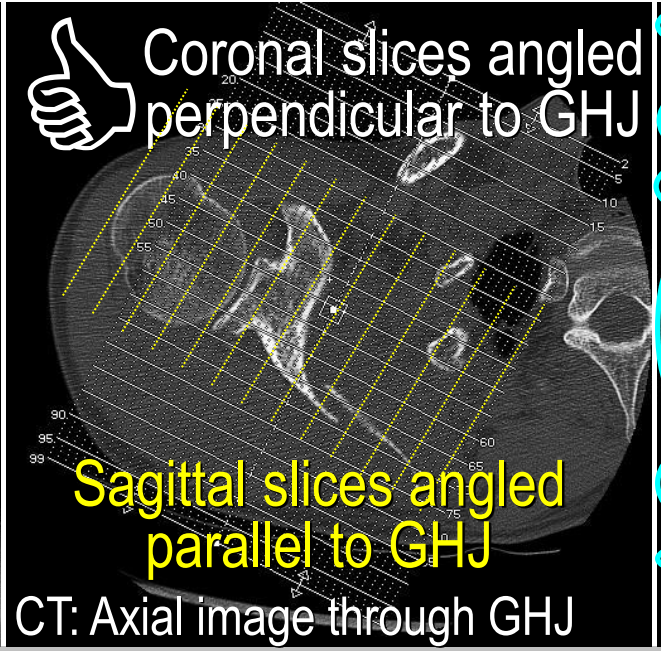
3) Optimize Reformats

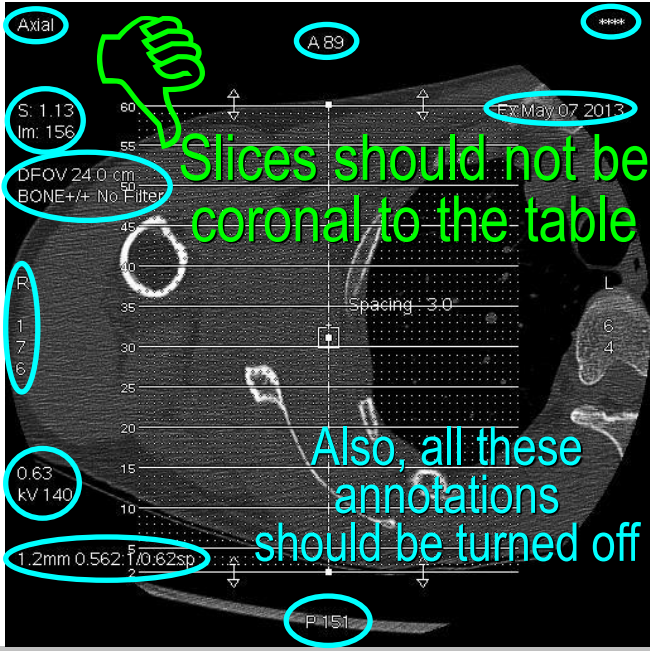
- Angle slices relative to ANATOMY *Not relative to table*

Overly aggressive shrugs:
Angle axial reformats



Coronal slices angled perpendicular to GHJ



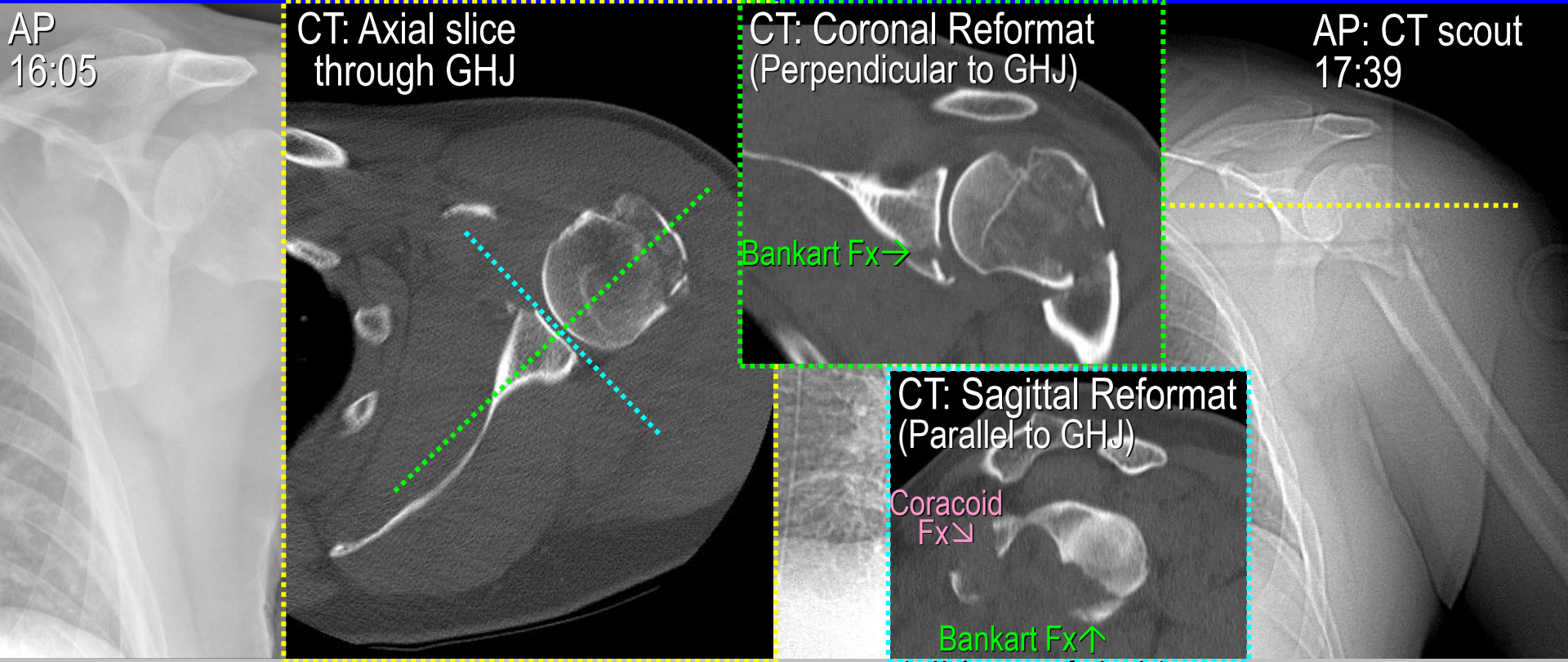


Optimizing Bone CT: Shoulder

3b)Optimize 3-D Reformats

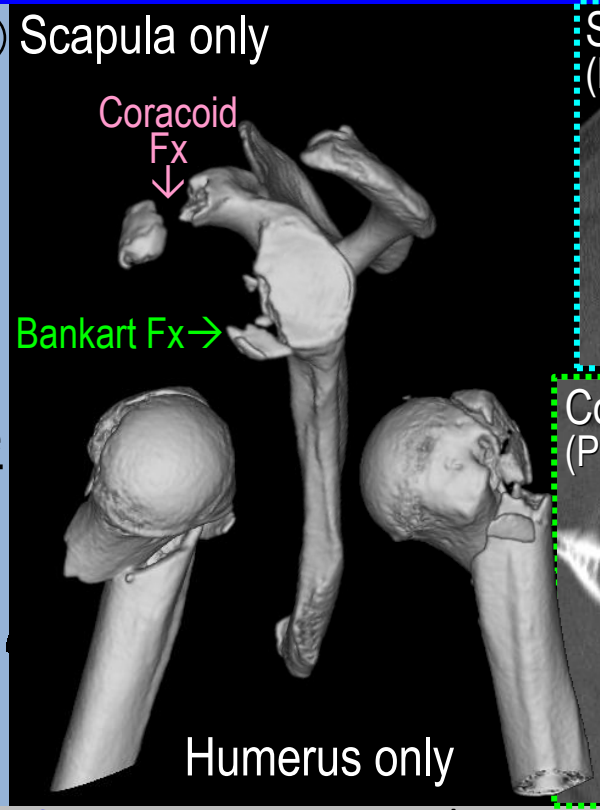
- ✓Series of 36 rotating images, 10° intervals
  - ❖Rotate around both vertical and horizontal axes
- ✓Disarticulate humerus/scapula

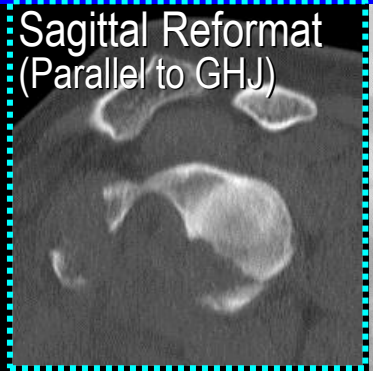
Case CT: 2D Reformats

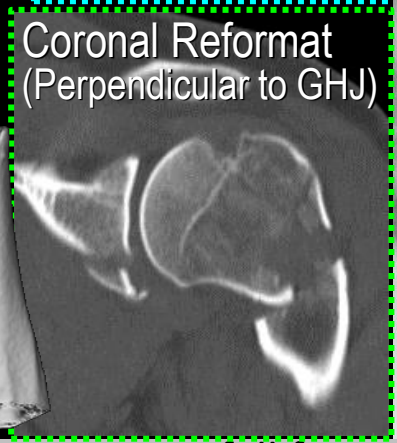


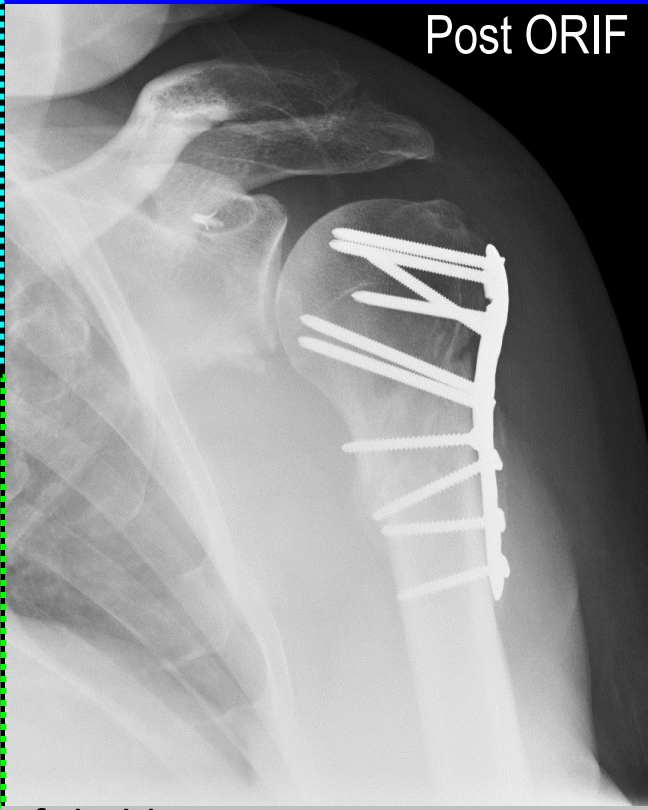
R,D 58yoM: Cleaning gutters, fell from 6ft ladder.
Fell on elbow, shoulder pain

CT: 3D Reformats









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