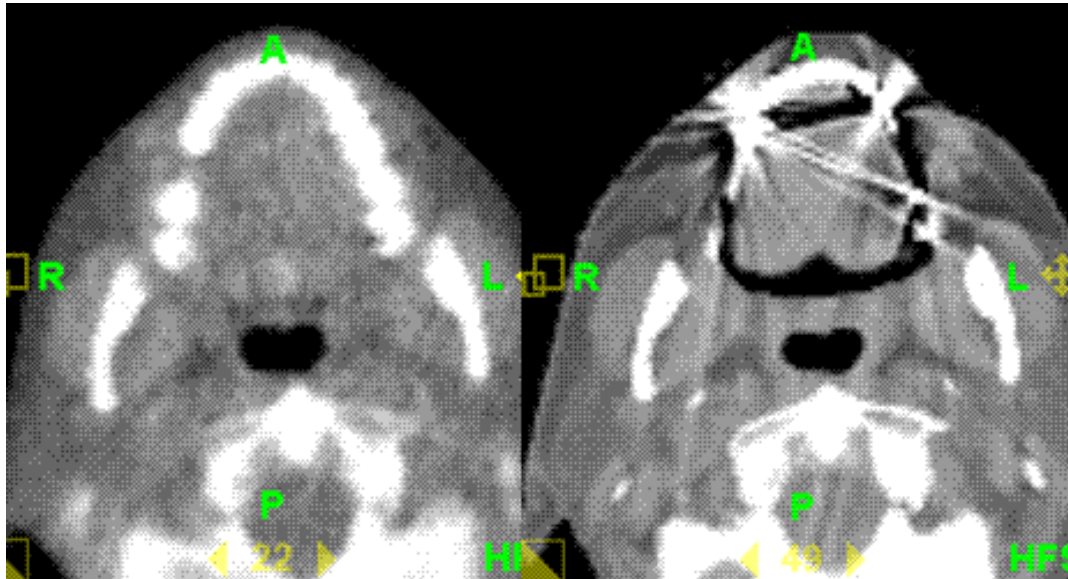
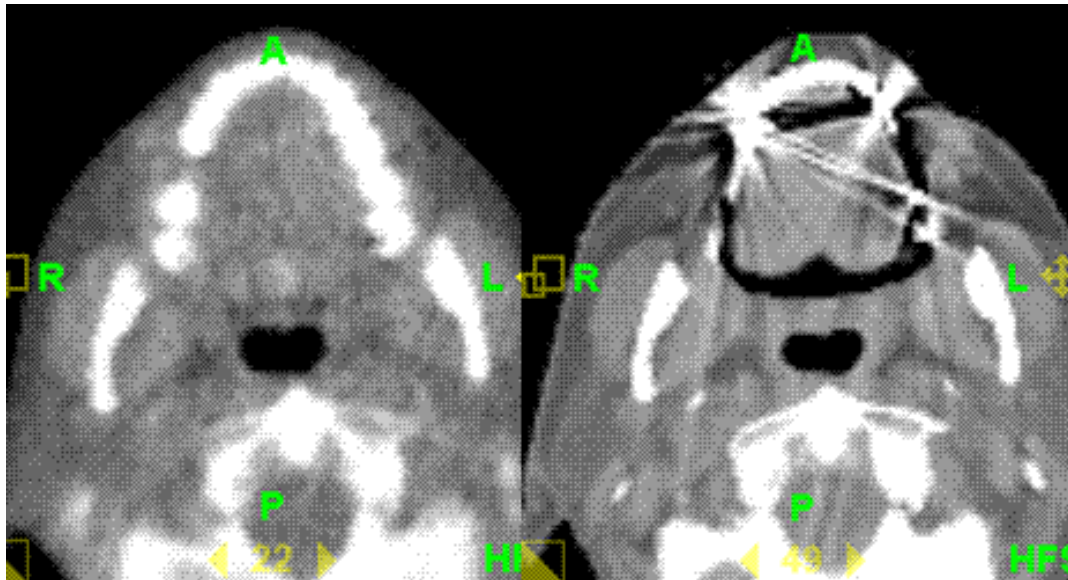


Imaging

These images are the same patient and same axial slice, what is the difference?

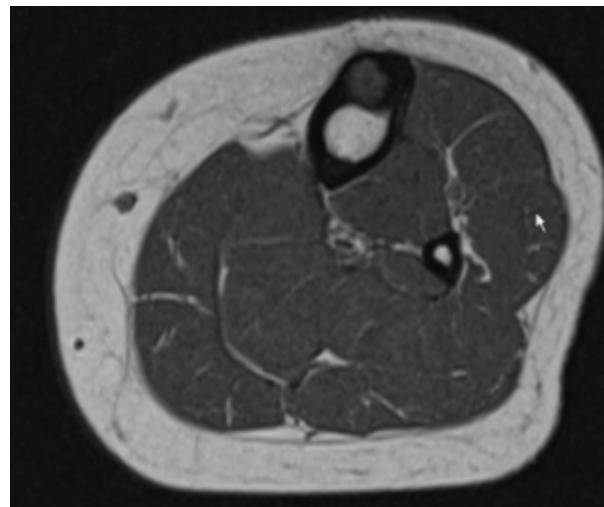
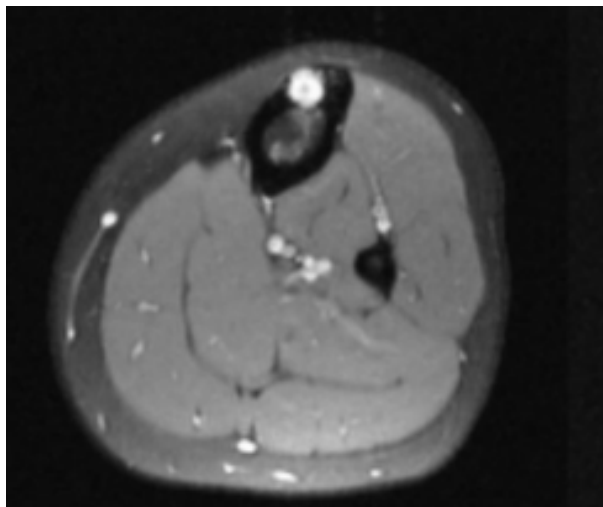


These images are the same patient and same axial slice, what is the difference?



- What are the pros and cons of each image acquisition technique?

What types of images are these?
What is the anatomy?



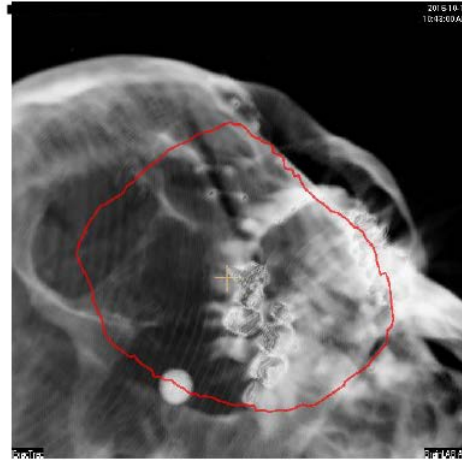
- How would these images be used for external beam treatment?
- What concerns would you have with using these images for external beam treatment?

What are the below images?

X-ray Correction Run



X-ray Image (Tube 1)



DRR Image Post-Registration (Tube 1)



X-ray Image (Tube 2)



DRR Image Post-Registration (Tube 2)

- How does image registration work?
- What are the different types of image registration?
- Which one is appropriate for this clinical situation?

What is the image below?



What is the image below?



- What type of detector does fluoroscopy use?
- What is the typical dose to the patient and how do you minimize dose to the patient?
- What is the source of dose to personnel and how do you minimize dose to personnel?

Resources:

<http://pubs.rsna.org/doi/full/10.1148/rg.312105185>

<http://pubs.rsna.org/doi/full/10.1148/radiographics.21.4.g01jl271033>

<https://www.aapm.org/meetings/03am/pdf/9790-14134.pdf>

- 1. Image intensifier or flat panel
- 2. Dose to patient is highly variable
 - Entrance exposure rates typical:
 - 1-2 R/min, thin body parts
 - 3-5 R/min, average patient
 - 8-10 R/min, heavy patient

Decrease patient dose by:

- Decrease time!
- Heavy filtration (0.2 mm Cu)
- Low frame rate pulsed fluoro
- Low dose ABC options
- Last frame hold

- Max dose rate = 10 R/min in Colorado:

- <https://www.sos.state.co.us/CCR/GenerateRulePdf.do?ruleVersionId=1413>

- CCR Part 2 appendix 2C

- Fluoro tabletop entrance exposure rate must be less than 25 R/min at the point where the useful beam enters the patient except when recording fluoro images or optional high level control is activated.

CCR 6.5.3

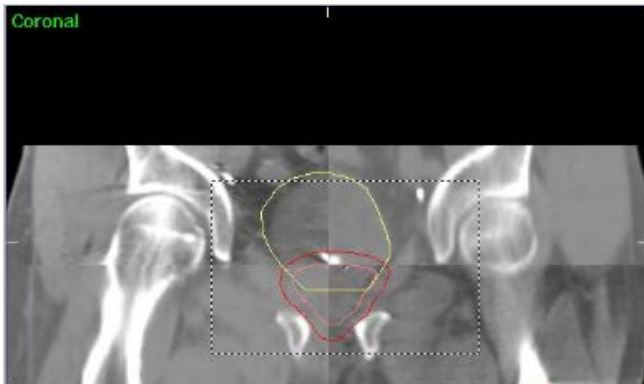
- Entrance exposure rate limits (units manufactured on or after 5/19/95)
- AERC required for beam with exposure rate > 5 R/min where center of useful beam enters patient
- Not operable with exposure rate > 10 R/min where center of useful beam enters patient
- Except:
 - During recording of images from xray II operated in pulsed mode
 - When high level control is activated, in which case not operable in excess of 20 R/min where center of useful beam enters patient. Continuous manual operation and audible signal during high level operation required.
- Measurement Point =
 - 1 cm above table if source below
 - 30 cm above table if source above

SSD >=

- 38 cm on stationary units installed after 9/1/92
- 35.5 cm on stationary units before 9/1/92
- 30 cm on mobile units

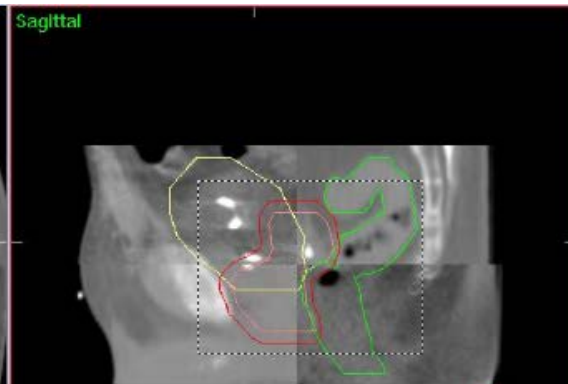
- 3. Dose to personnel from leakage and scatter*
 - Leakage negligible compared to scatter
 - NCRP reg = < 100 mR/hr at 1 m
 - Scatter @ 1m from patient $\sim 0.1\%$ of incident beam.
 - Increases with:
 - Increasing field size
 - Increasing entrance exposure
 - Increasing DAP rate
 - Increasing kVp

- To reduce personnel dose:
 - Minimize beam on time
 - Increase distance from patient
 - Remove grid when possible, esp small patients and body parts
 - Be on beam exit side of patient (have x-ray tube UNDER table when possible)
 - Collimate tightly
 - Geometry:
 - Tube far from patient
 - II close to patient
 - Magnification mode use sparingly
 - Use movable shielding
 - Use personnel shielding
 - 5 mm lead apron recommended
- Attenuates:
 - 99%, 50 kVp
 - 88%, 75 kVp
 - 75%, 100 kVp
 - 1 mm lead apron attenuates ~100% of all kVp beams, but heavy (12-24 lb)

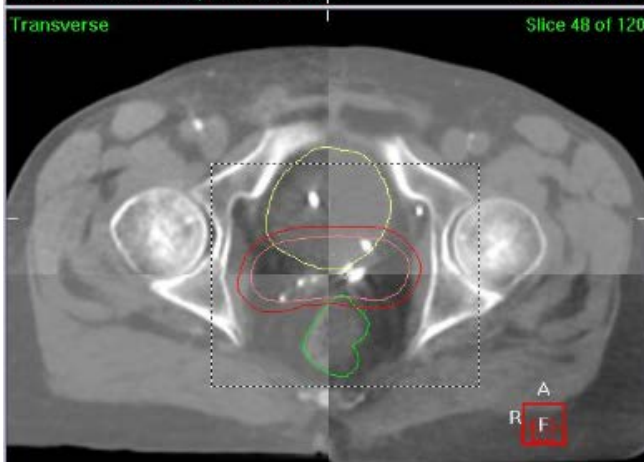


Correction reference point = isocenter

Slice 185 of 410



Slice 205 of 410



22.11.2016 10:56:04.000

Scan Time: 25.10.2016 15:04:28.000

Reference Preset		Alignment	
<input checked="" type="checkbox"/> Scan	<input type="text" value="Cor. Ref. Point"/>	<input type="button" value="Automatic"/>	<input type="button" value="Grey view"/>
<input checked="" type="checkbox"/> Alignment Clipbox	<input type="button" value="Structures..."/>	<input type="button" value="Reset"/>	
<input type="button" value="Convert To Correct"/>			
Position Error		Table Correction	
Translation (cm)		Rotation (dg)	
X	<input type="text" value="0.23"/>	X	<input type="text" value="0.0"/>
Y	<input type="text" value="0.23"/>	Y	<input type="text" value="0.0"/>
Z	<input type="text" value="0.24"/>	Z	<input type="text" value="0.0"/>
Lateral Longitudinal Vertical			
<input type="button" value="Dismiss"/>		<input type="button" value="Accept"/>	

List the following image modalities in order of **increasing patient dose**:

- CBCT
- MRI
- CT
- MVCT
- PET
- 4DCT
- SPECT
- Radiograph (film)
- Radiograph (DR)



List the following image modalities in order of increasing patient dose:

1. MRI
2. Radiograph (DR)
3. Radiograph (film)
4. CT
5. CBCT
6. MVCT
7. SPECT
8. 4DCT
9. PET/CT

List the following image modalities in order of **increasing spatial resolution**:

- CBCT
- MRI
- Ultrasound
- CT
- MVCT
- PET
- 4DCT
- SPECT
- Radiograph (film)
- Radiograph (DR)