Image Optimization in Fluoroscopy

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Image Optimization in Fluoroscopy

Key Considerations

- Contrast to noise
- Temporal fidelity
- Dynamic Range Rendering
- Visual Perception
- Skin Dose
Exposure ON-time

- Under control of the interventionalist
- Once procedure begins it generally does not end until the intervention is complete
- May result in fluoroscopy time measured in hours
The Challenge for Medical Physics

discuss these effects, or……

T.R. Koenig, M.D., Ph.D.; L.K. Wagner, Ph.D.; F.A. Mettler, M.D. and D. Wolff, M.D.
Radiation Injury to the Skin Caused by Fluoroscopic Procedures: Lessons on Radiation Management
Scientific Exhibit Cum Laude - RSNA 2000
The Challenge for MP’s

…… prospectively understand and optimize these ……

- Patient Dose
- X-ray tube kVp
- Image Quality
- Beam Filtration
Fluoroscopic Radiation Capture/Conversion

Indirect Conversion FPD

Direct Conversion FPD

X-ray

Light (Input Phosphor)

Electrons (Photo-Cathode)

Light Image (Output Phosphor)

Video Signal (CCD Camera)

Digital Signal

X-ray

Light (CSI)

Electric signal (Photo diode)

Digital Signal

X-ray

Digital Signal
Dynamic Range Rendering
Is Contrast Required?

Native

Subtracted
Is Contrast Required?

Native

Subtracted
Imaging Task #5

What’s wrong with this image?

Continuous Fluoro  Pulsed Fluoro
Sharpness

Continuous Fluoro

Pulsed Fluoro
How Much Dose?

Fluoroscopy - 0.036 µGy/pulse

Acquisition Frame - 3.6 µGy/frame
X-ray Tube Potential

Does patient dose depend on detector dose?

Attenuator: 20 cm water

- EERD: 90 µR/sec
- SEER: 5 R/min
- SEER: 2.5 R/min
Does patient dose depend on detector dose?

Attenuator: 20 cm water

SEER: 5 R/min
SEER: 2.5 R/min
EERD: 90 µR/sec

Tube Potential (kVp) vs. Tube Current (mA) graph.
Dose Per Pulse
Dose Per Pulse
Dose Per Pulse
Image Quality

Contrast to Noise Ratio vs KVp

- Low attenuation region (high signal), 0.2 mm Cu
- Low attenuation region (high signal), 0.4 mm Cu
- High attenuation region (low signal), 0.2 mm Cu
- High attenuation region (low signal), 0.4 mm Cu

Fluoro kVp & beam filtration
Human Visual Perception

- To help reduce missed findings, medical images should be associated with a specific task.
- The imaging modality selected should be that which optimizes the success of the imaging task.
Imaging Task #3

- This task is intended to test your ability to interpret a moving image and focus on a specific task.
- For this task, assume the tolerance for error is zero.
- You will be assigned to a team.
- Each team will have a different task to perform using the same image.
Imaging Task #3
Final Imaging Task

How can this be true?

Below the four parts are re-ordered

The four parts are exactly the same as those used above

Why is there an extra square?

Thank you

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