

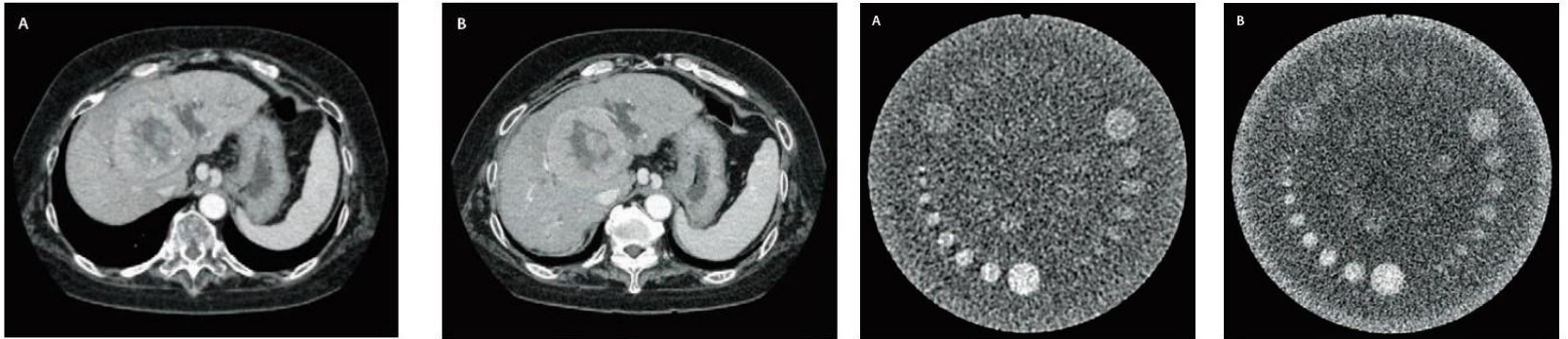
Initial Experience with Canon AiCE Deep Learning Reconstruction

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Advanced Intelligent Clear-IQ Engine (AiCE)

- AiCE is a machine learning technique used to differentiate and remove noise from signal
 - Uses both deep learning (object recognition) and neural networks (mimic of human brain)
- Creates images with improved SNR



Courtesy of Canon Medical Systems

Advanced Intelligent Clear-IQ Engine (AiCE)

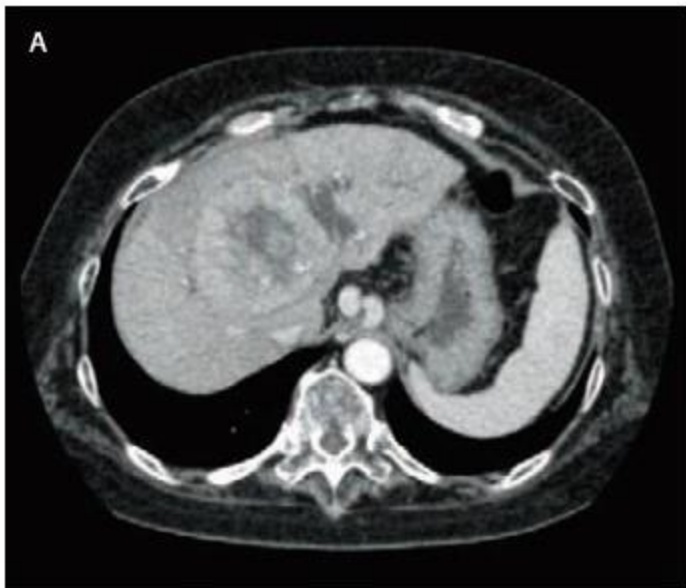
- Trained in the factory using high mA, MBIR images together with ‘sophisticated’ noise models
- Incorporated into the ^{SURE}Exposure mA modulation
- AiCE compares the acquired image to a ‘gold standard’ and adjusts it’s output to create an optimal image
- Also trained with low quality images to learn how to create high quality outputs

*Taken from the Canon AiCE White Paper: AiCE Deep Learning Reconstruction: Bringing the power of Ultra-High Resolution CT to routine imaging. K Boedeker

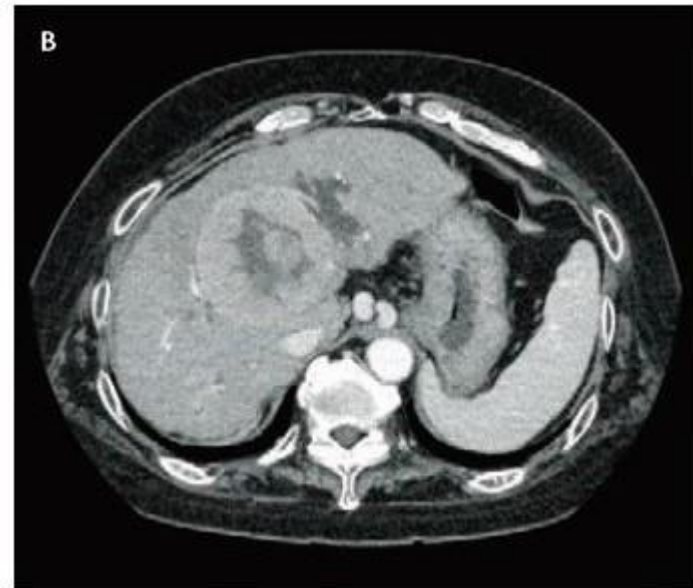
https://eu.medical.canon/publication/ct/2019WP_AiCE_Deep_Learning

What does it look like in practice?

UHR AIDR 3D at 11.8mGy



AiCE at 12.4mGy

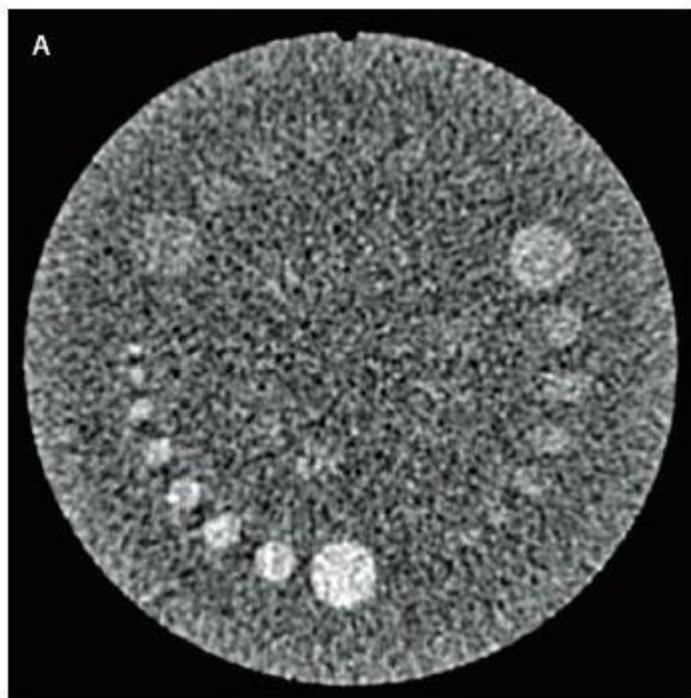


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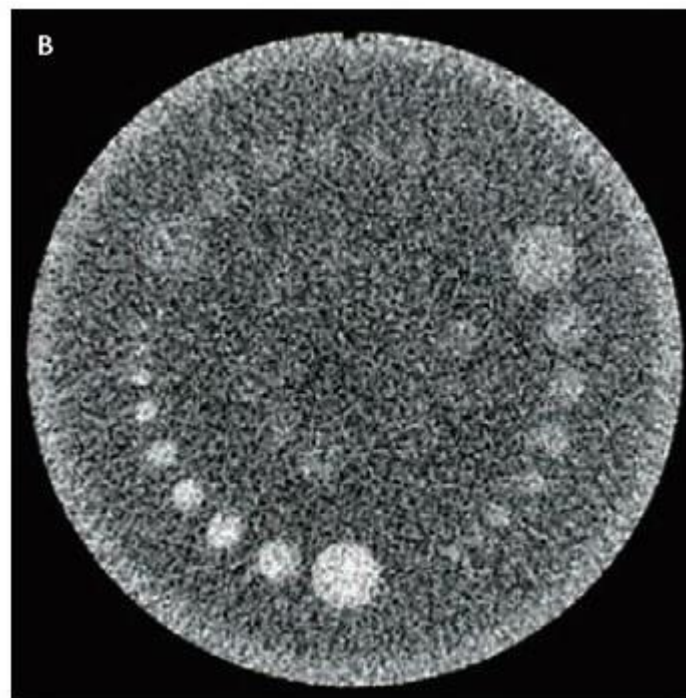
world class expertise  **local care**

What does it look like in practice?

AIDR 3D



UHR AiCE



Courtesy of Canon Medical Systems

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Advanced Intelligent Clear-IQ Engine (AiCE)

- Starts in raw data domain and makes modifications based on detailed scanner model information
- Goes through multiple layers of the neural network to enhance specific features and ignore others
- Initially designed for the Aquilion Precision Scanner – Ultra High Resolution Scanner

Data Collection

- 2 Aquilion Prime SP Scanners
 - One in ED at Royal Free
 - Commissioned in 2017 – no AiCE
 - One in North Central London (NCL) Community Diagnostic Centre
 - Commissioned in 2021 – with AiCE
- Scan protocols matched as far as possible between both scanners

First steps

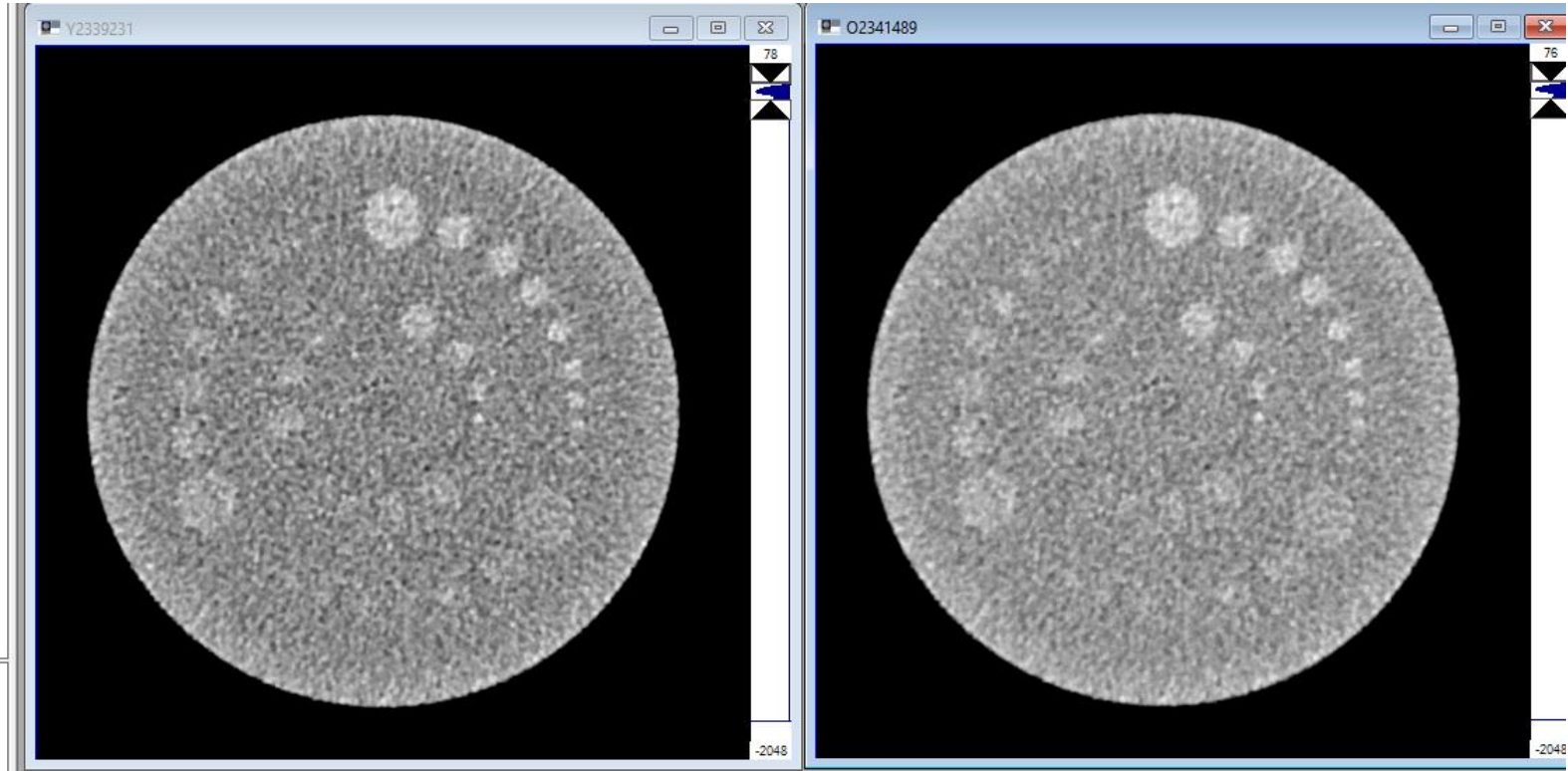
- At commissioning we used Catphan and tested various settings

First steps

- At commissioning we used Catphan and tested various settings

Recon Kernel	HC Resolution	LC Resolution		
FC18 (Body)	6	8	6	4
FC30 (Bone)	7	7	4	0
FC07 (LD Neck)	6	8	6	2
FC18 AiCE Std	6	8	6	3
FC18 AiCE Body Weak	6	6	3	0
FC18 AiCE Body Strong	6	6	6	0

Image Quality



FC18

FC18 AiCE Std

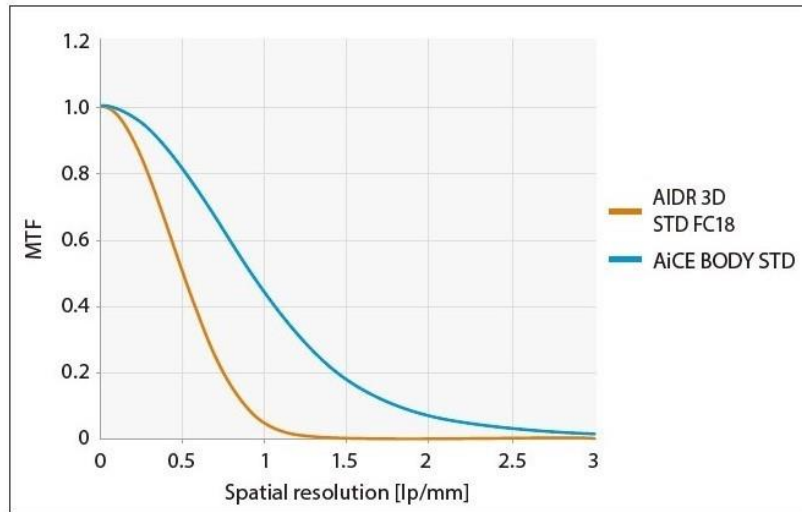
Task based IQ

Recon Kernel	SNR	CNR	MTF 50 (lp/mm)
FC18	15.0	2.66	0.38
FC30	3.16	0.47	0.69
FC07	16.2	3.04	0.36
FC18 AiCE Std	17.3	2.77	0.39
FC18 AiCE Weak	16.3	2.61	0.38
FC18 AiCE Strong	20.1	3.14	0.39

Using Catphan largest LC detail and bead

MTF

Canon Data



Courtesy of Canon Medical Systems

Measured data

Recon Kernel	MTF 50 (lp/mm)
FC18	0.38
FC30	0.69
FC07	0.36
FC18 AiCE Std	0.39
FC18 AiCE Weak	0.38
FC18 AiCE Strong	0.39

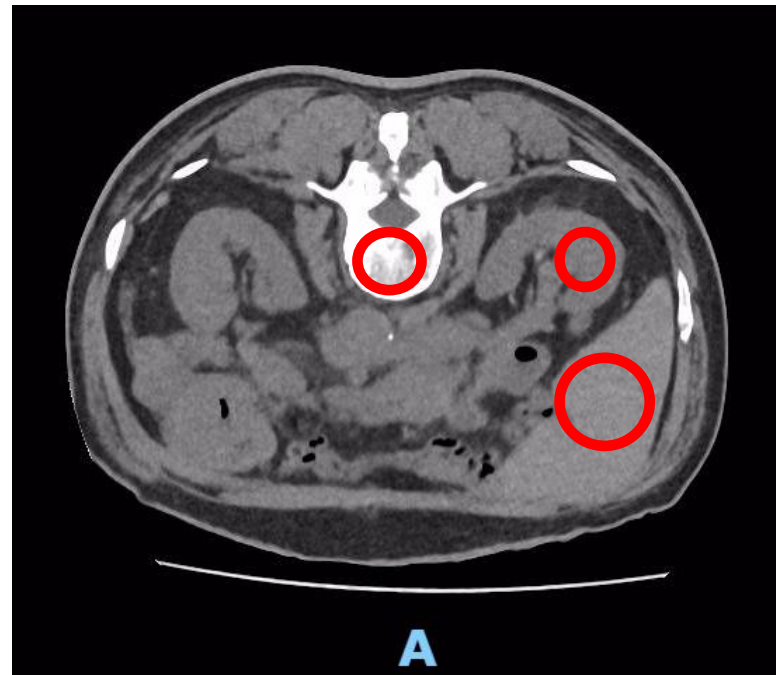
Next step - Patient Data

- Audited the first year of NCL Scanner data
- 147 patients scanned on both RFH Scanner and NCL Scanner
- Of those patients:
 - 53 Urograms
 - 8 Heads
 - 2 Chests

Performed on the same patient on both scanners

Data Analysis - Urograms

- Looked at SNR, CNR and CTDI in both sets of images
- Kidney, liver and bone

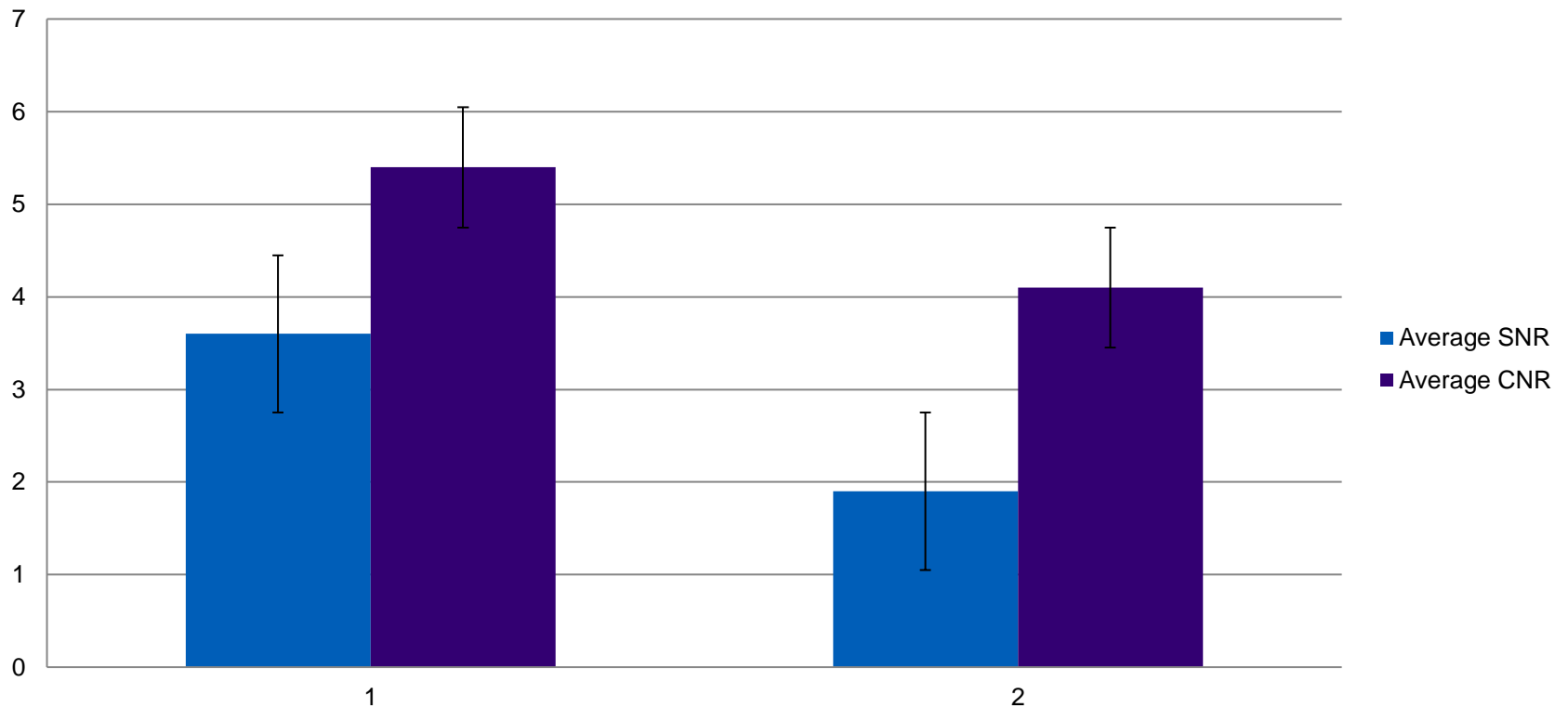


Results

Scanner	Average SNR (Kidney)	Average Noise (Kidney)	Average CNR (Liver/Spine)	Average CTDI (mGy)
NCL	3.6	9.3	5.4	3.0
A&E	1.9	17.5	4.1	3.9

SNR and CNR

Average SNR and CNR



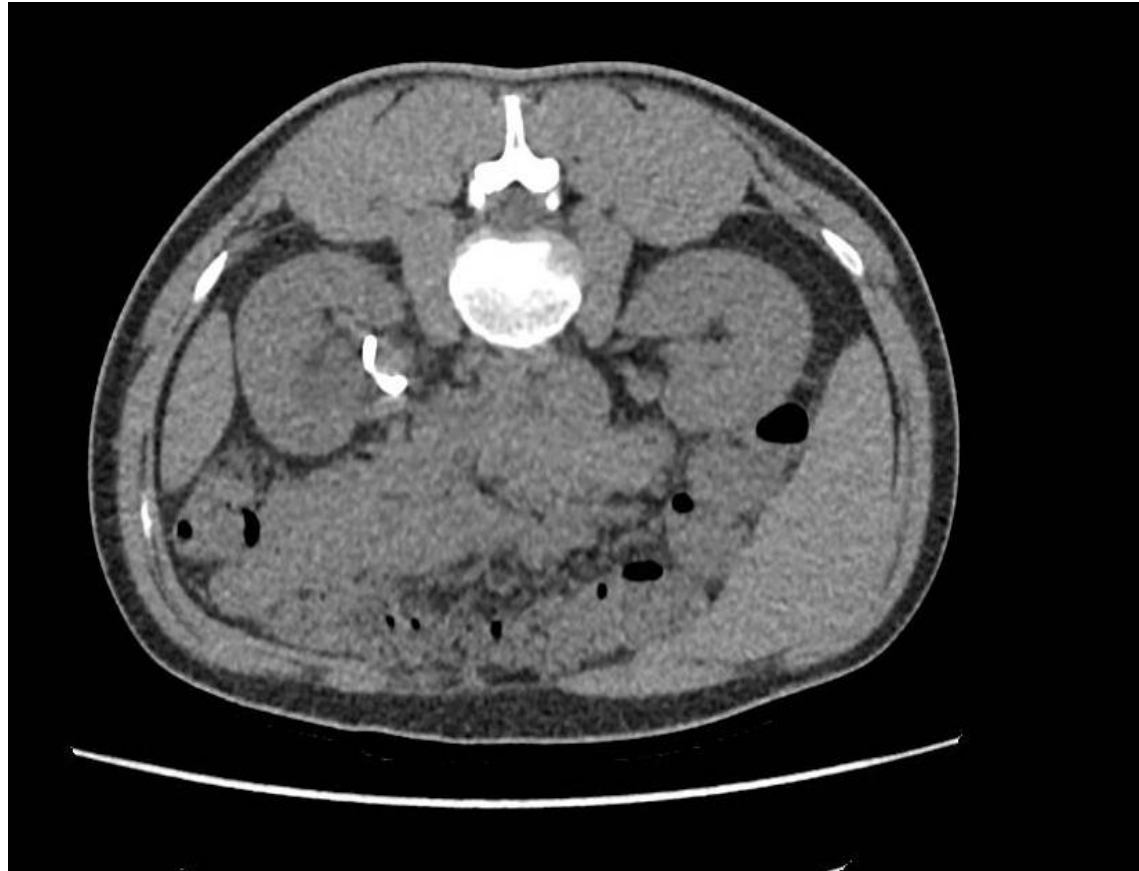
What do the images look like?

FC18 AiCE
Reconstruction



What do the images look like?

FC18 Std
Reconstruction



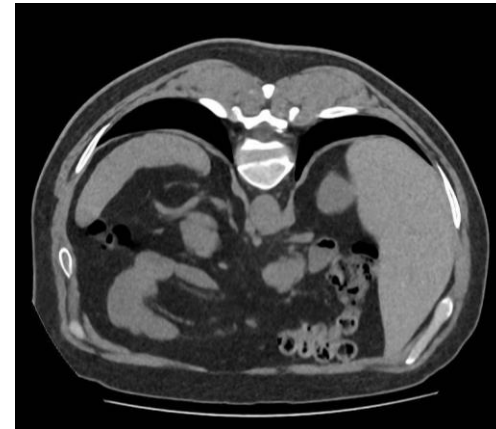
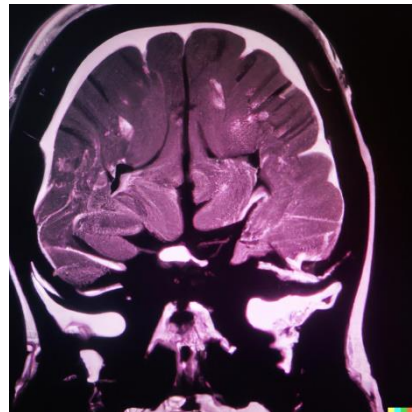
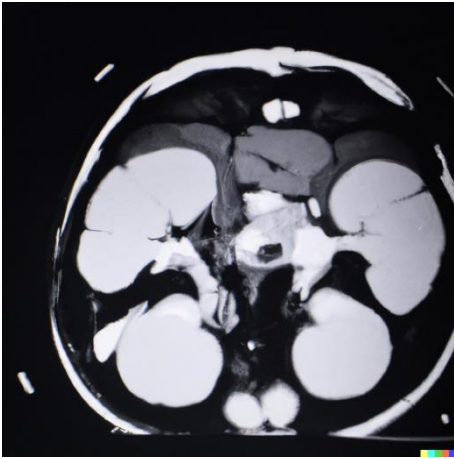
Radiologists Opinion

- A bit mixed
- ‘The images appear much too 'soft'. It looks like there has been too much smoothing of the image and you lose some of the interface between structures which can make it difficult to see if vessels are infiltrated etc.’
- But is it just that they ‘look’ different to what they are used to?

What next?

- Starting a trial of sending both sets of recons (AiCE + Std Recons) for selected protocols
- Chat to apps to see if things can be altered
 - Try implementing AiCE Mild to lessen noise reduction?
- Try introducing a less clinical/physics phantom and see how it copes
 - E.g. Catphan with guidewires taped to it
- Because – we don't know what we don't know
 - How does AiCE react to pathology or trauma patients?

Is it real?



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Questions?

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