Diffusion weighted imaging (DWI) for AMI

Introduction

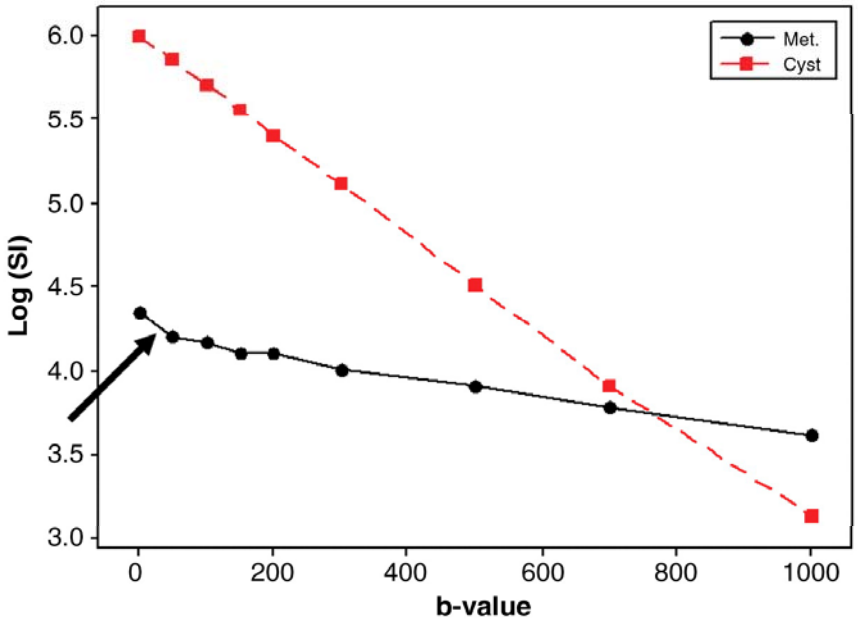
- Amount of restriction to water diffusion within cells is proportional to cellularity
  - Tumors (both benign and malignant) as well as abscesses demonstrate restricted diffusion
  - Areas of low cellularity or where extracellular membrane has been breached do not demonstrate restricted diffusion
- DWI takes advantage of these properties by demonstrating differing signal intensities in tissues based on their cellularity

How it works

- DWI is a SS-EPI T2 weighted sequence acquired with free breathing, breath hold or respiratory triggering
  - Diffusion gradients are placed on either side of a 180 degree pulse, in the x, y and z directions
  - Two or three B values are selected (< 50, 400-500, 800-1000)
    - B value is represented by a combination of gradient amplitude, length and time between gradients, although usually only gradient amplitude is changed
  - Chemical fat suppression or IR

How it works

- Degree of water motion proportional to signal attenuation
  - Increased water motion = signal attenuation
  - As the B value goes up (1000), tissues with high cellularity (tumors) are attenuated less when compared with the normal parenchyma
- Two or three B values are selected, in order to generate a slope, based on the signal of different tissues
- This slope is represented by the ADC map



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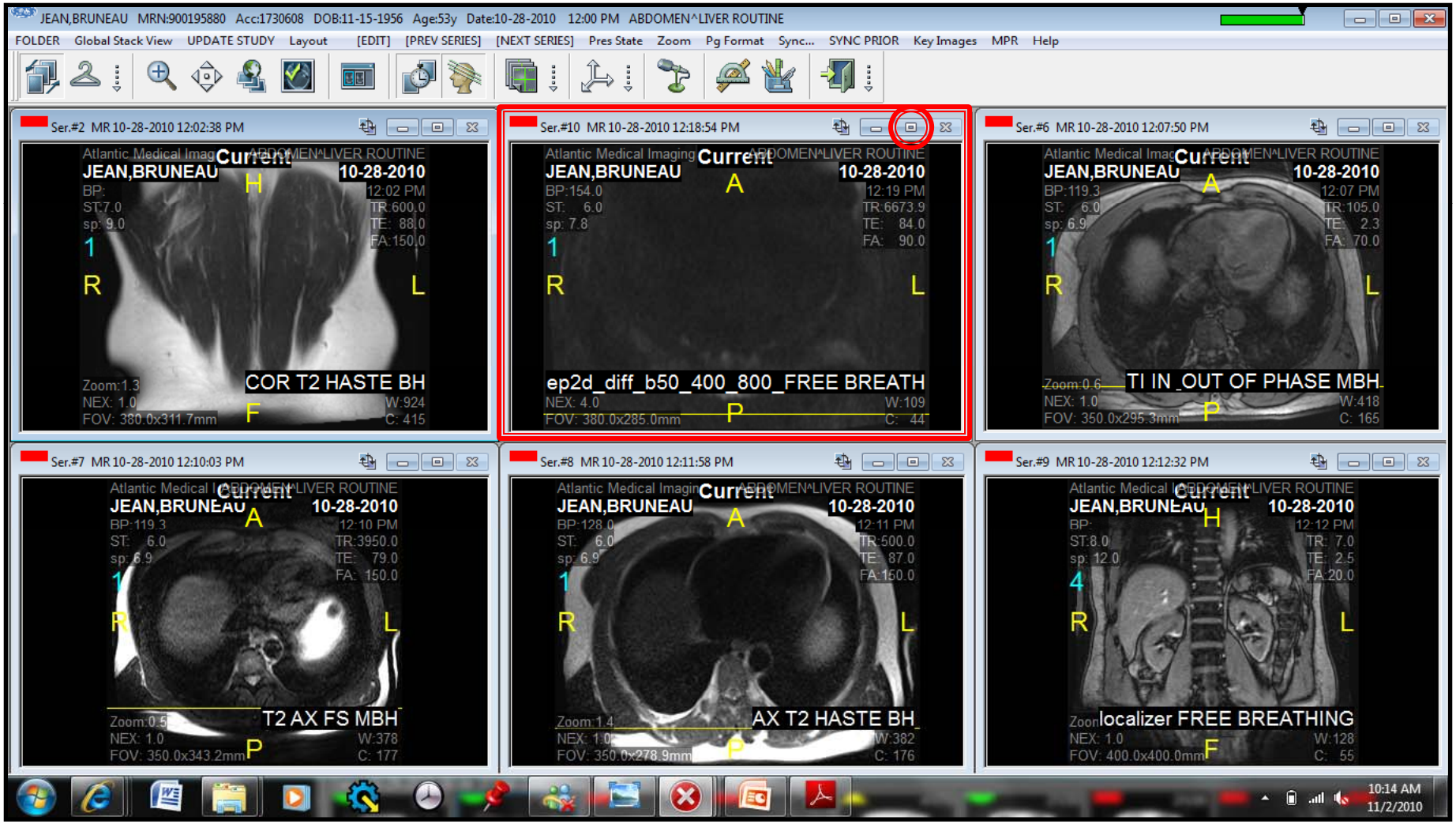
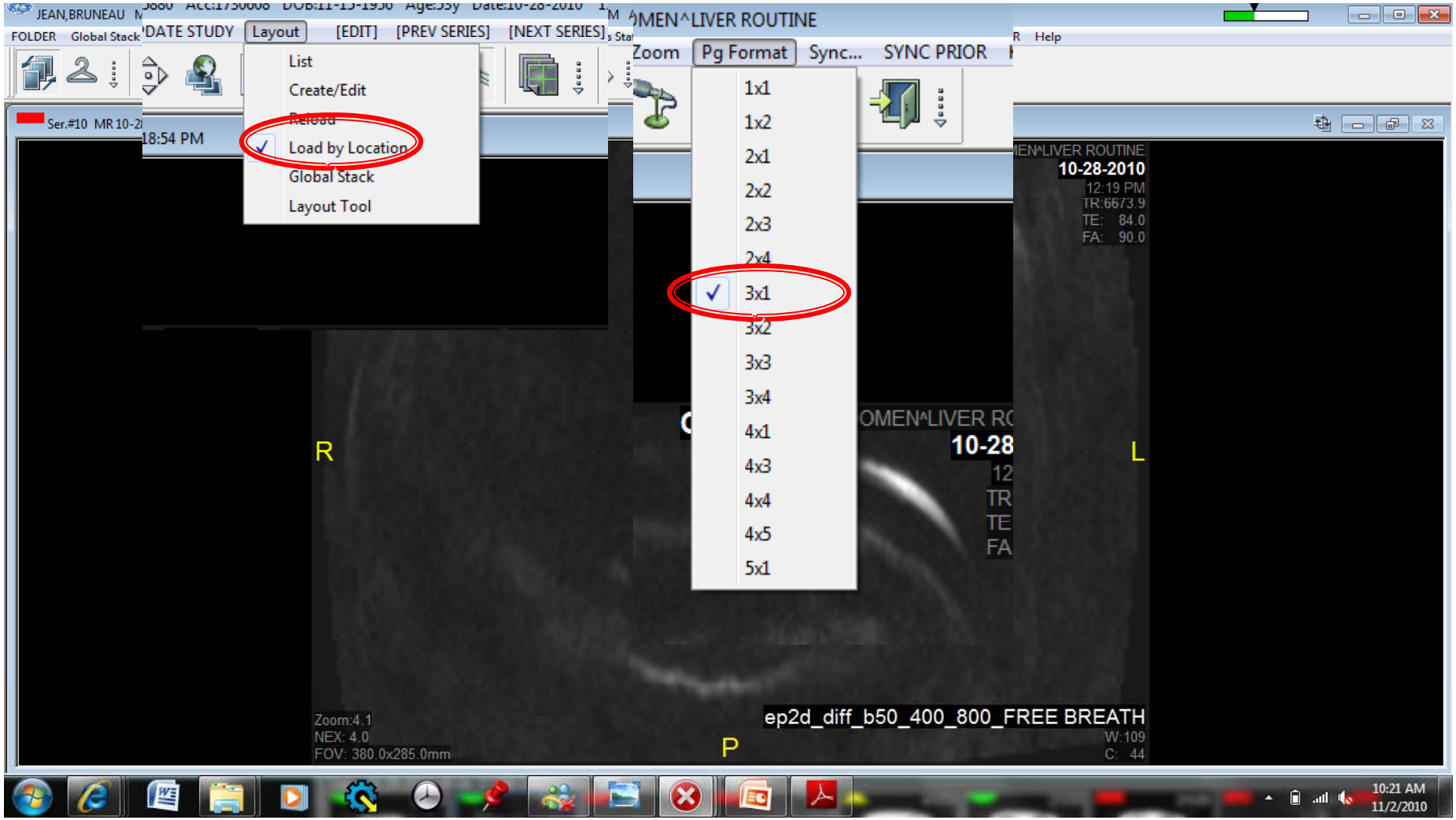
How it works

- On every magnet but EHT, Festival and Wall open, we have a B0 and B600
  - At EHT: B50, B400 and B800….Siemens
  - At Wall open and Festival….no DWI
- We are in the process of trying respiratory triggered DWI
- Two respiratory triggered DWI sequences take ~ 3 minutes

Setting up your series



Setting up your series



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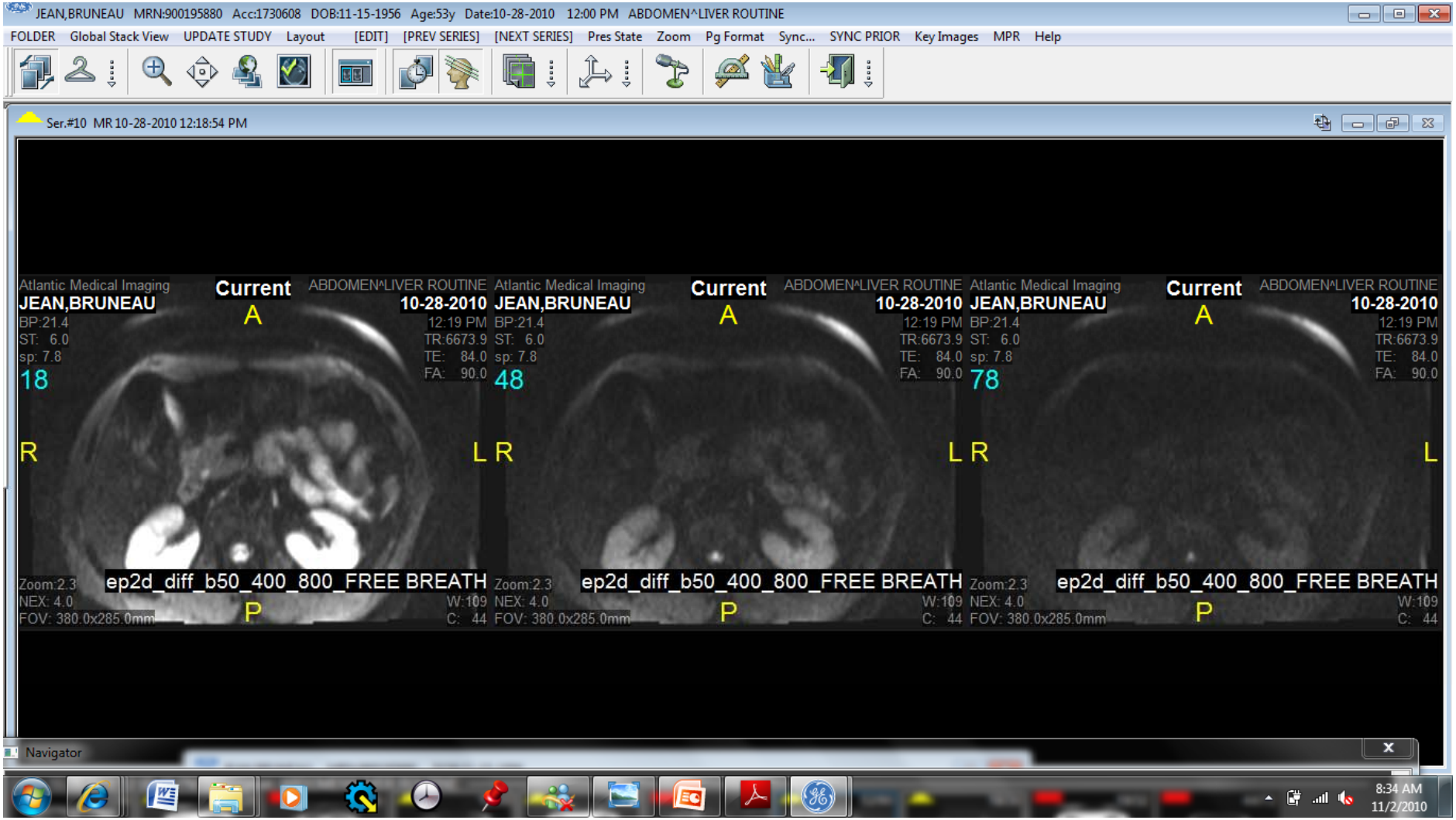
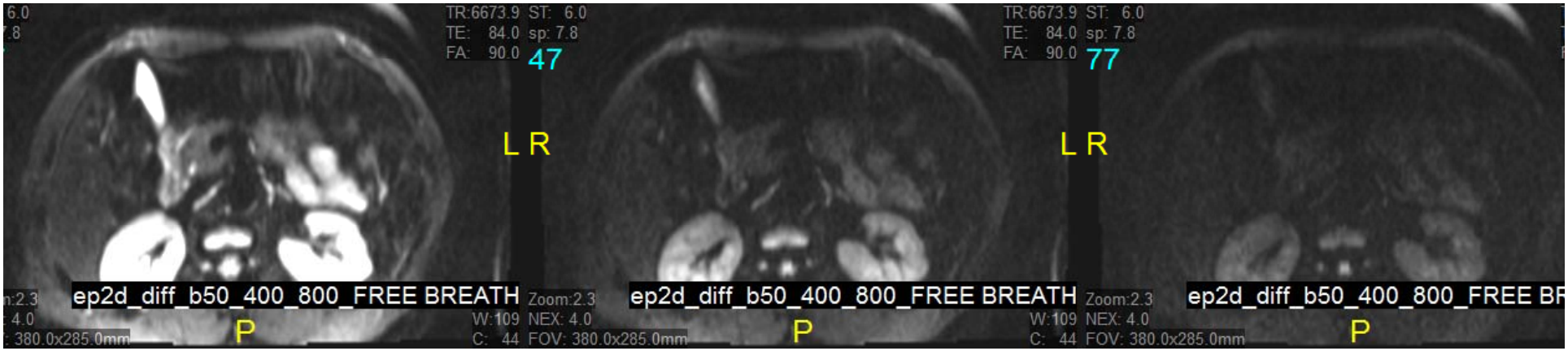
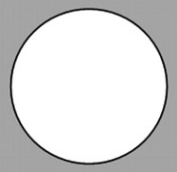
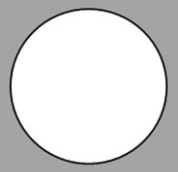
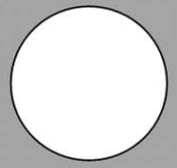
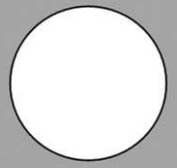
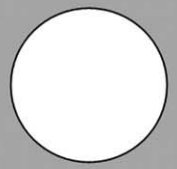
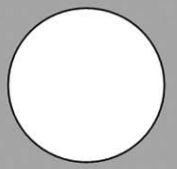
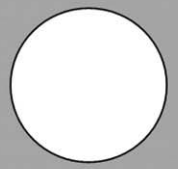


How to interpret DWI

- On Bo, CSF, GB and cysts will be bright
- On higher B values, CSF and cysts will not be as bright, while true lesions retain signal
- Caveat is that with T2 shine through, some cysts and hemangiomas will remain bright
  - Thus, the utility of the ADC map



How to interpret DWI

	b0	High b	ADC
Benign Lesion (E.g. cystic-necrotic lesion)			
Malignant Lesion (E.g. Metastasis)			
T2 shine through (E.g. cyst-hemangioma)			

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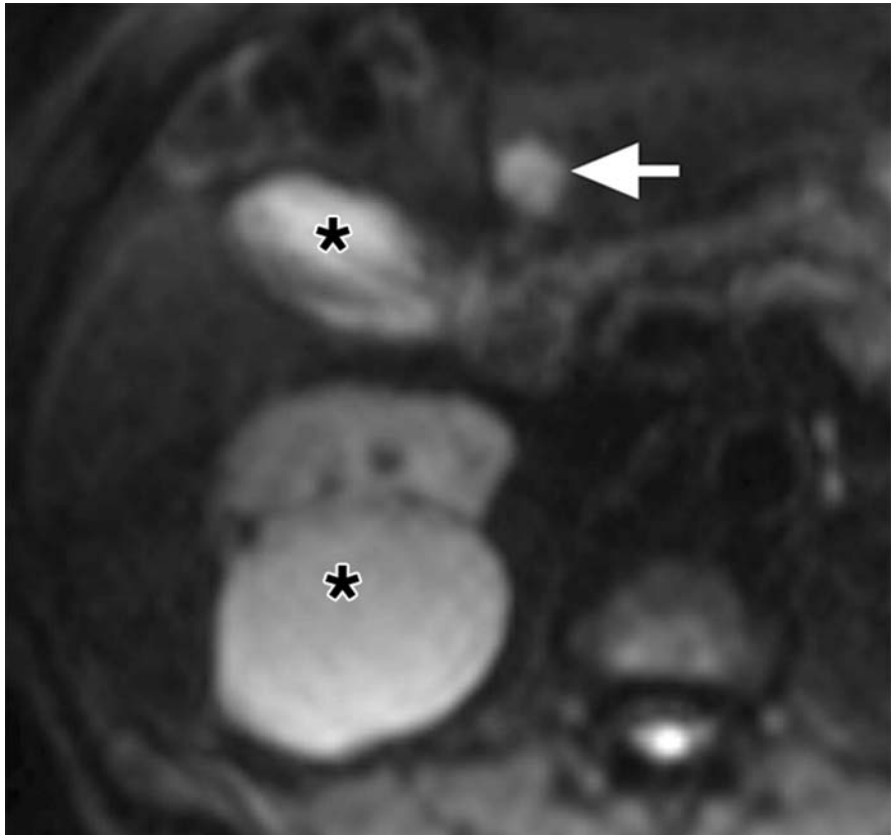
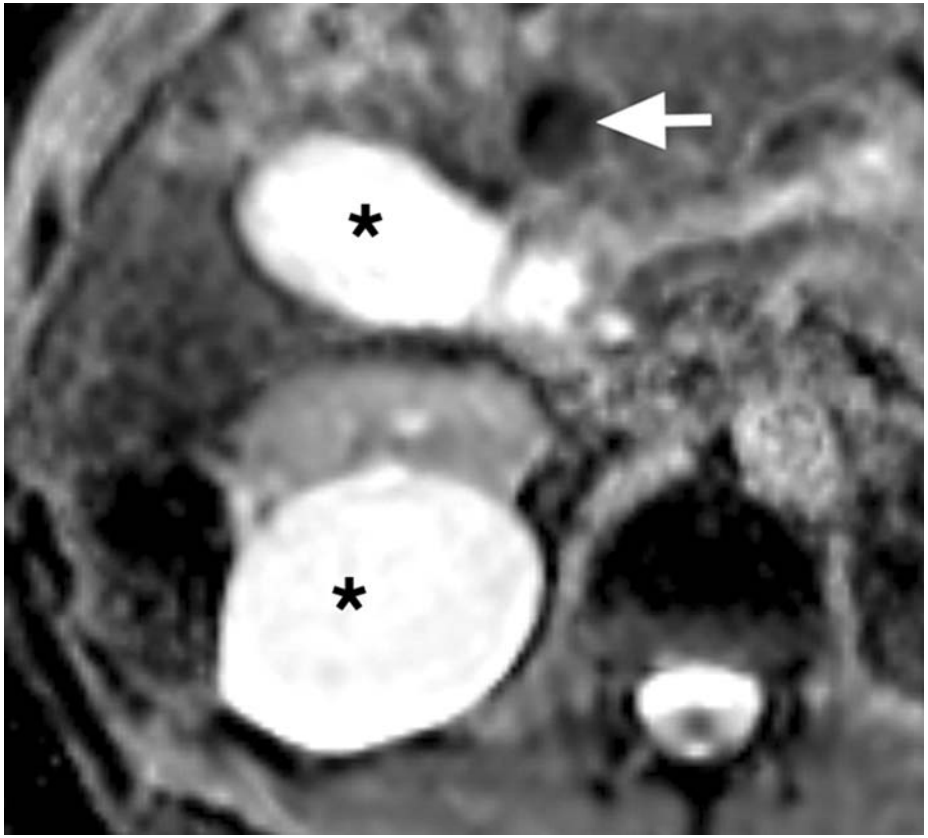
T2 shine through vs. Restricted diffusion





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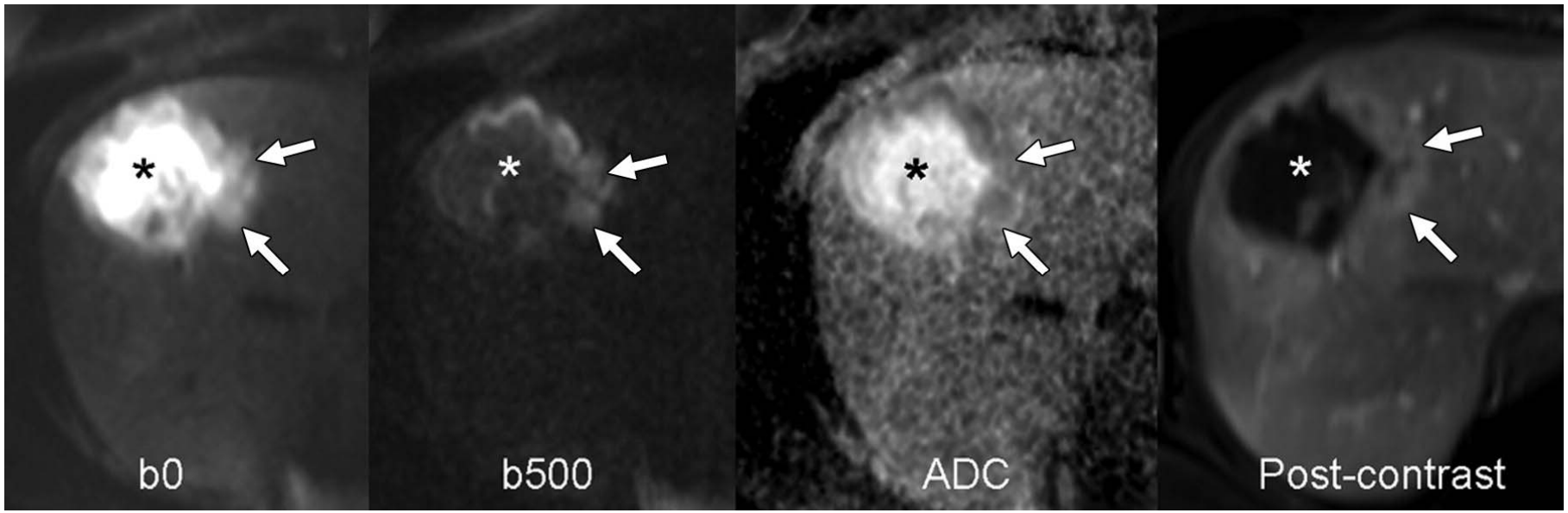

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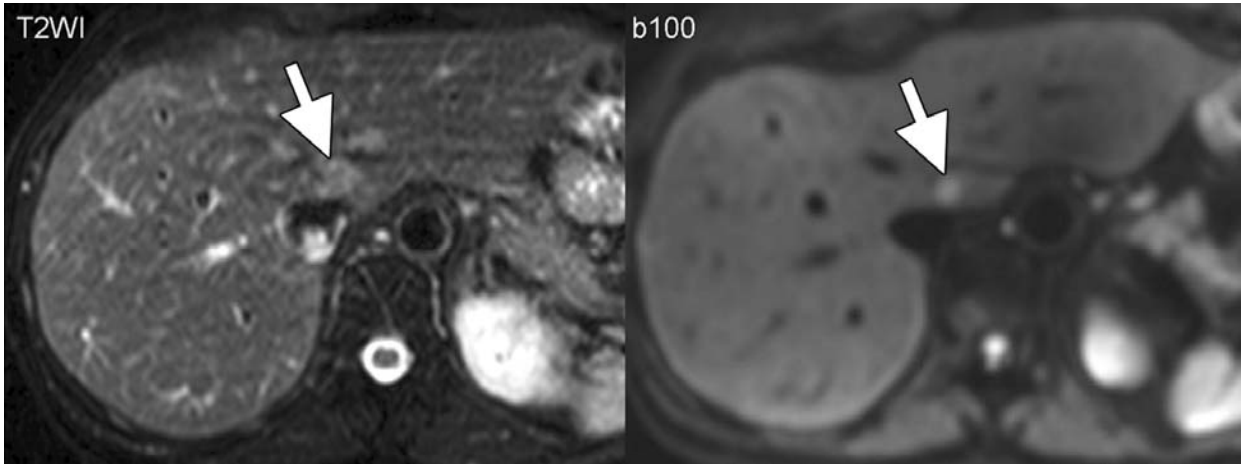
How I use it

- On Bo, helpful in evaluating for:
  - Adenopathy
  - Sensitive at lesion detection
    - Recent studies suggest higher sensitivity than T2 FS



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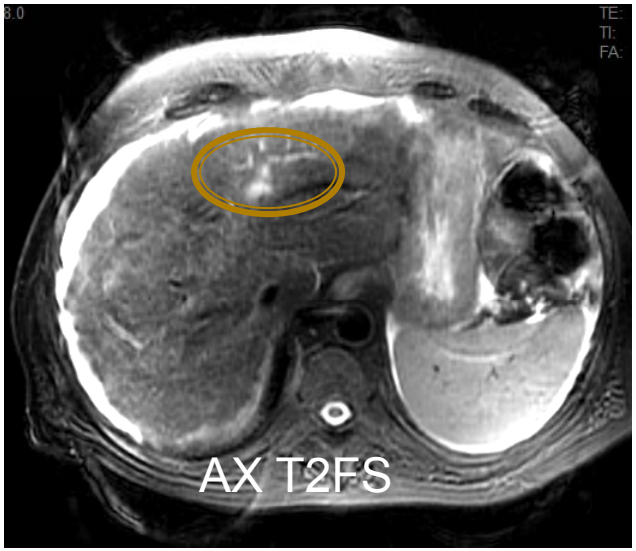

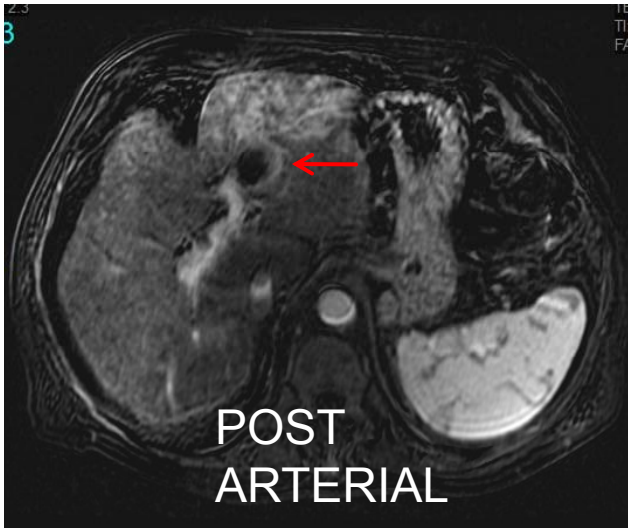

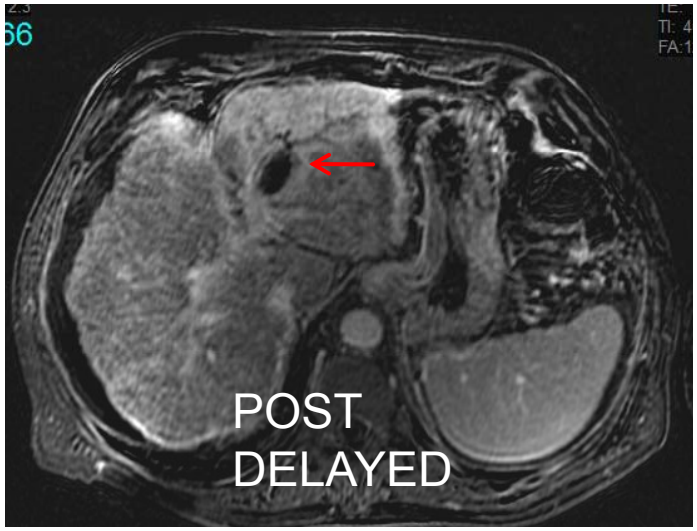

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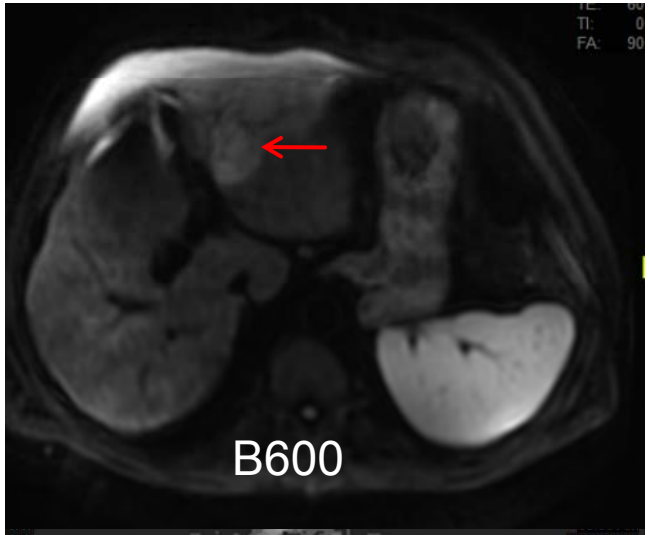

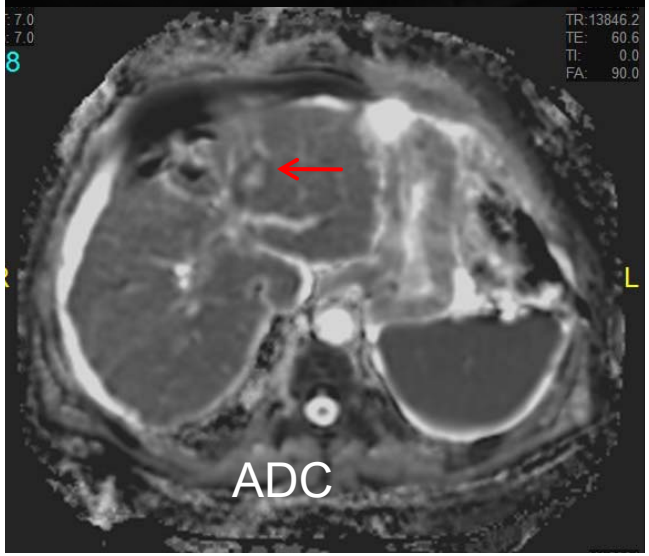

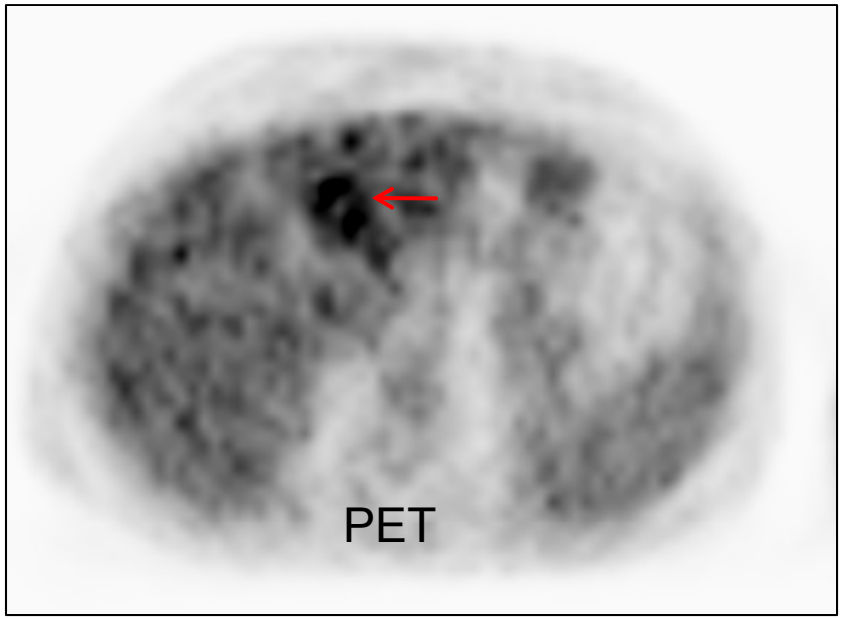

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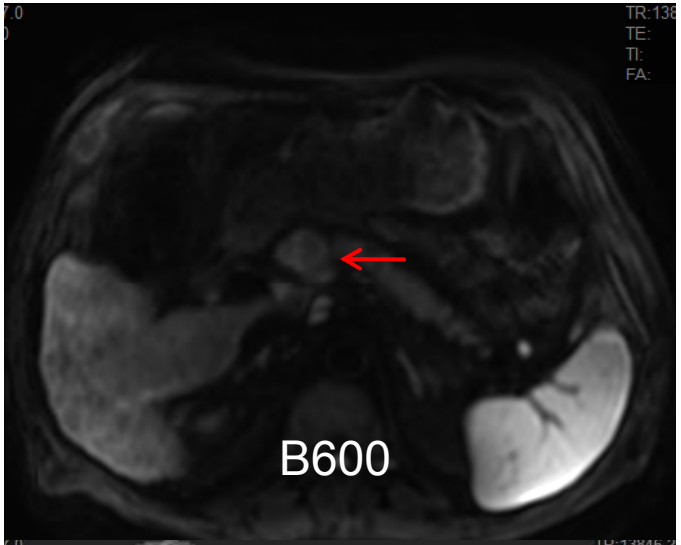

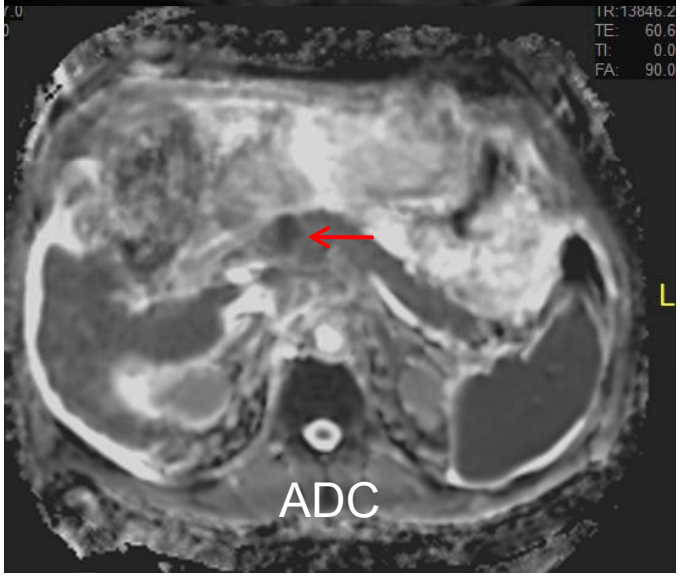

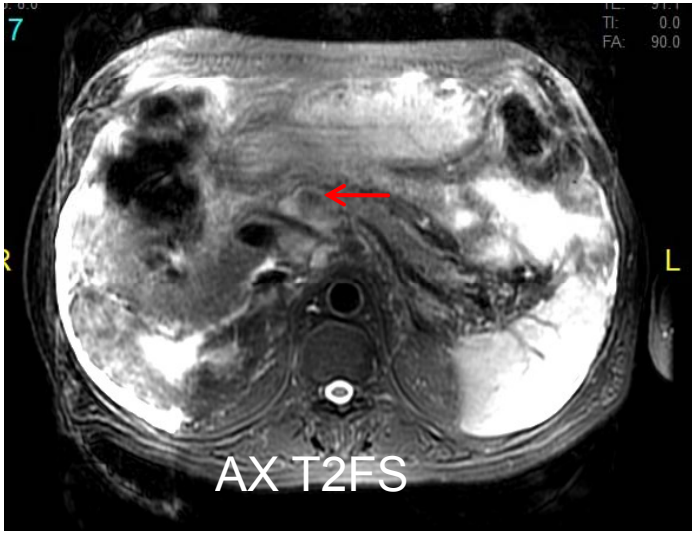

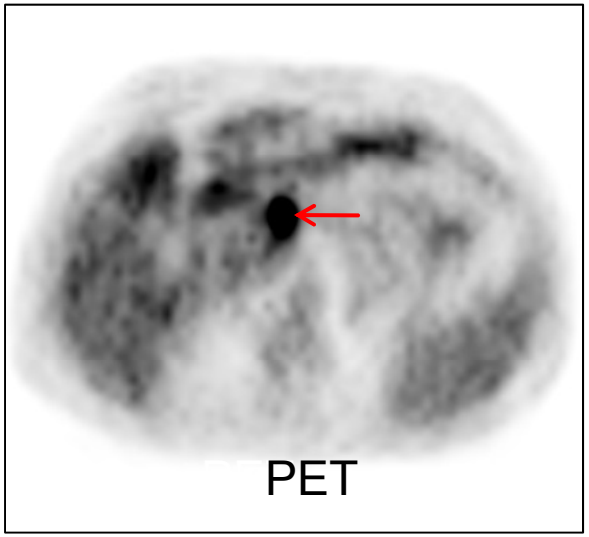

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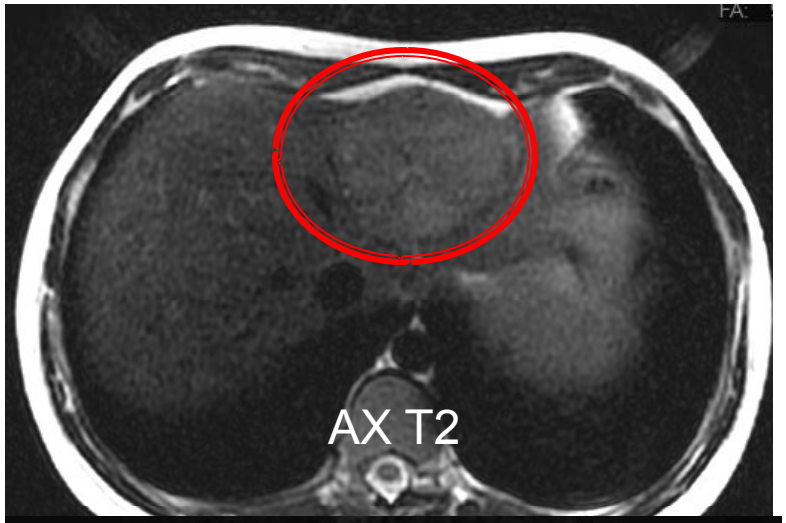
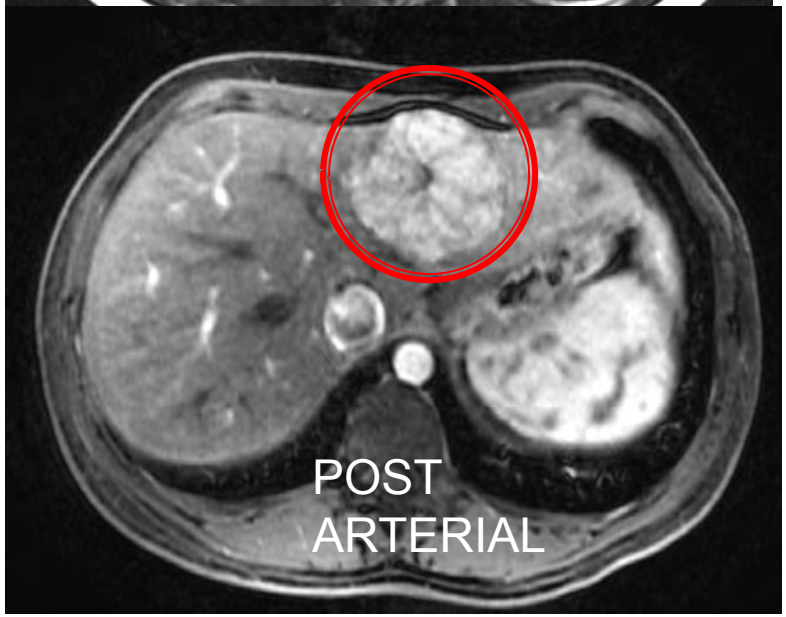
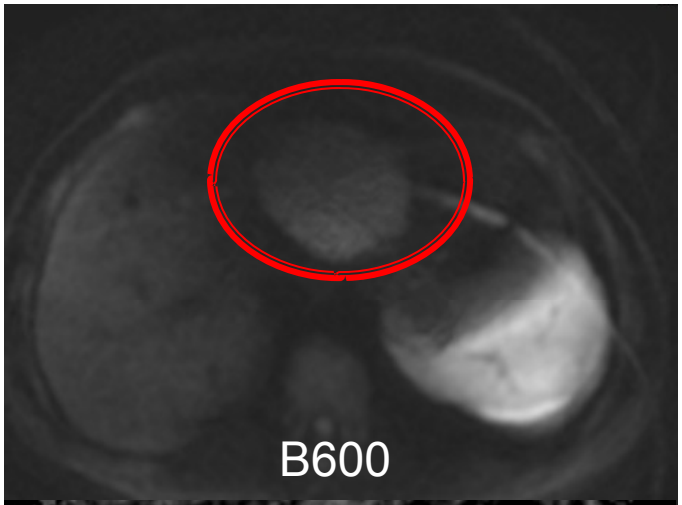
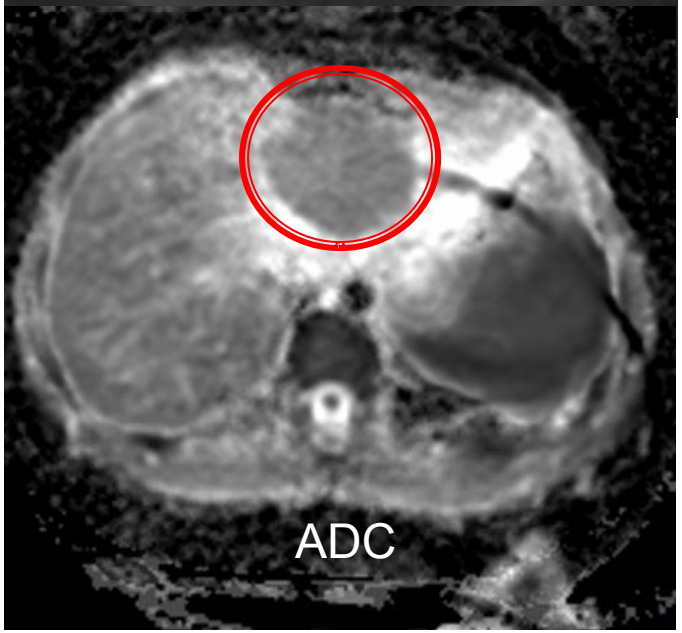


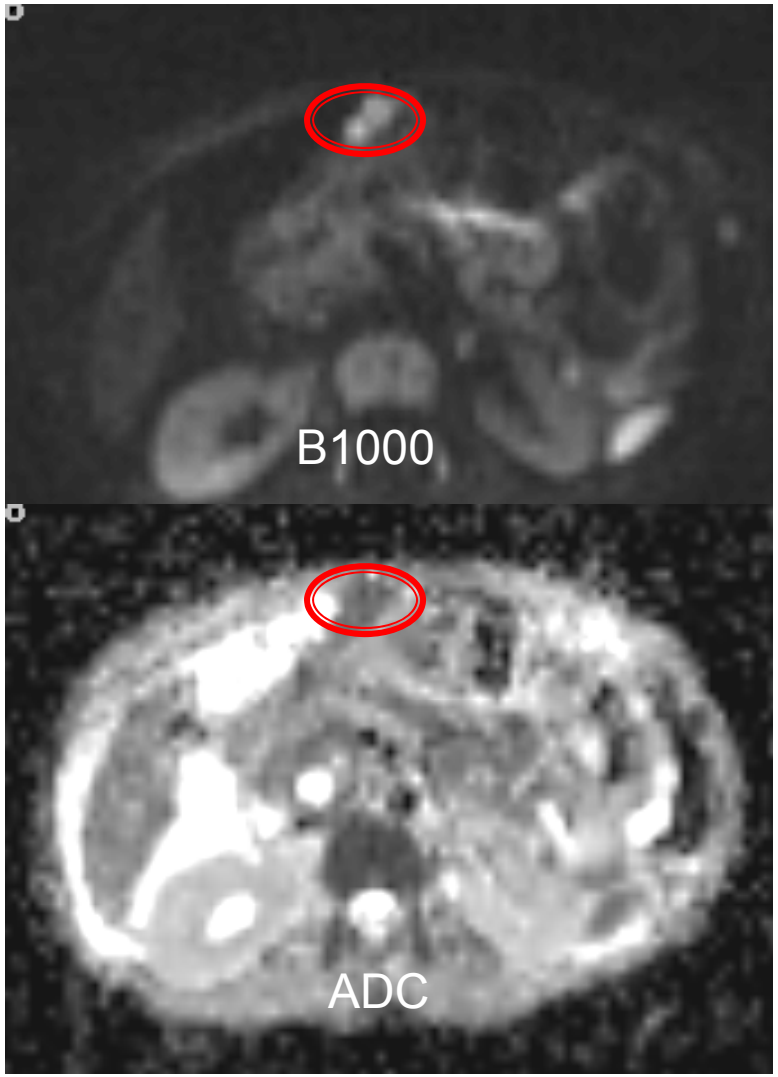






How I use it

- On higher B values, helpful for:
  - Evaluating for solid visceral lesions
  - Evaluating for peritoneal disease
  - Evaluating in patients who cannot get gadolinium



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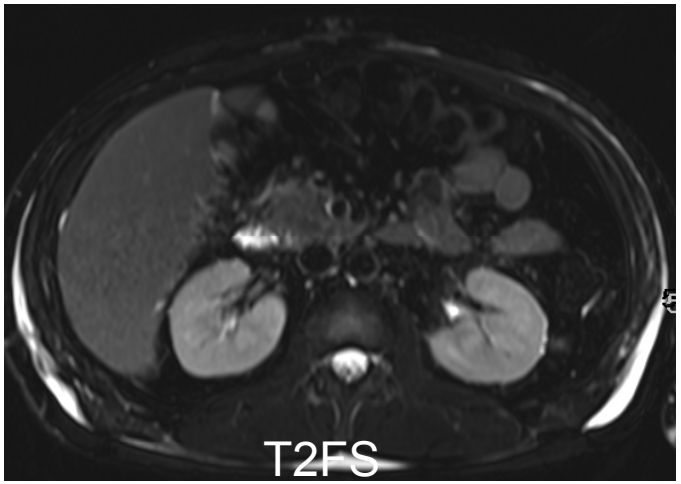

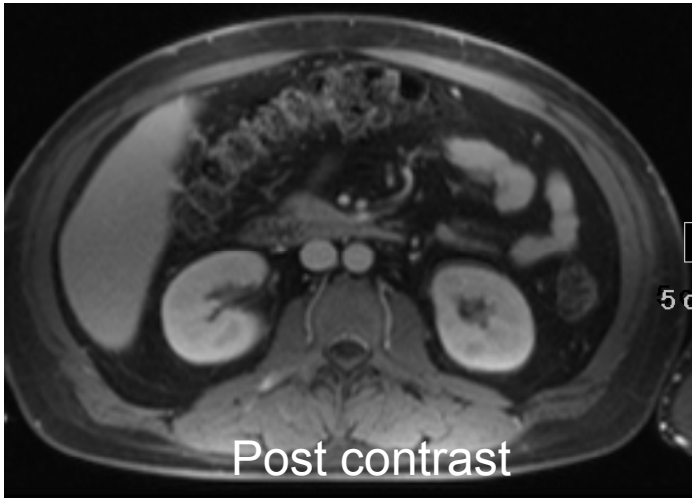

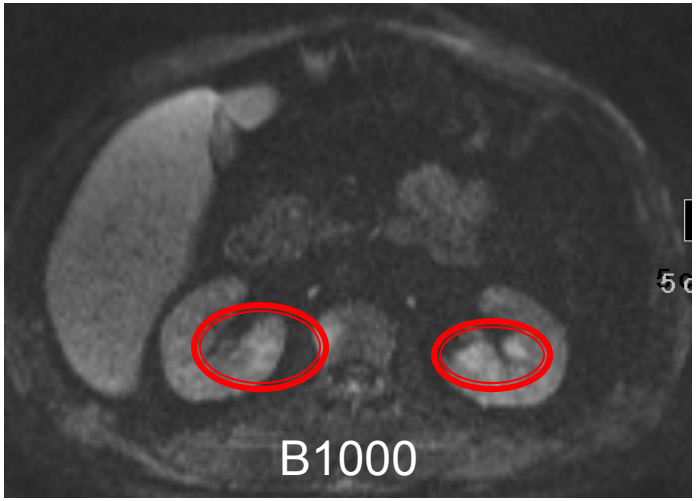

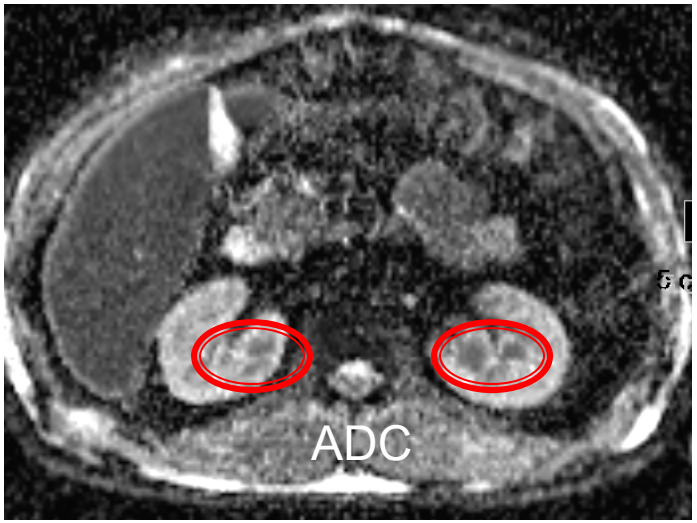

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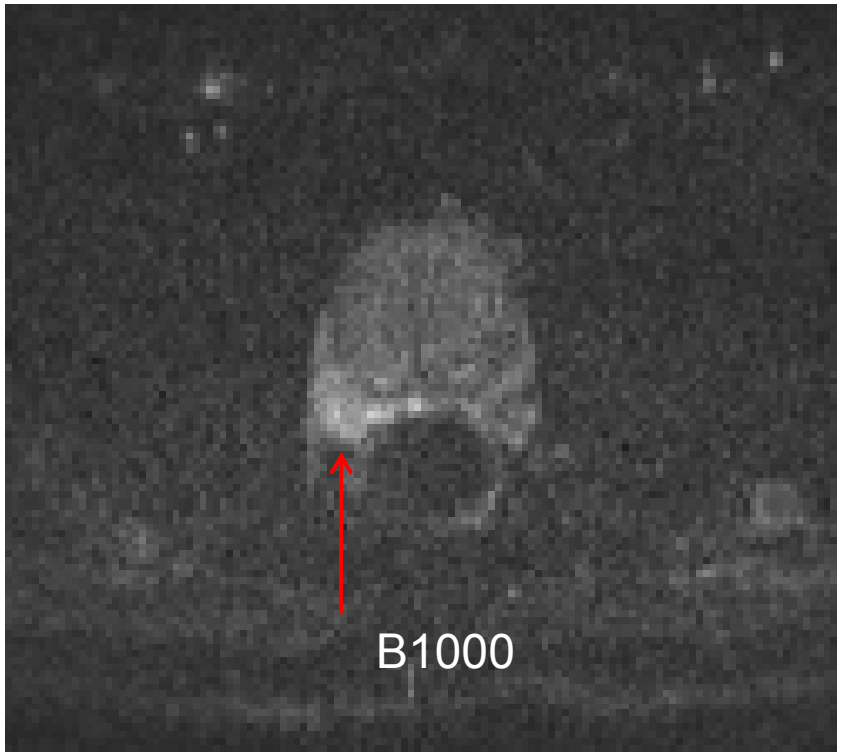

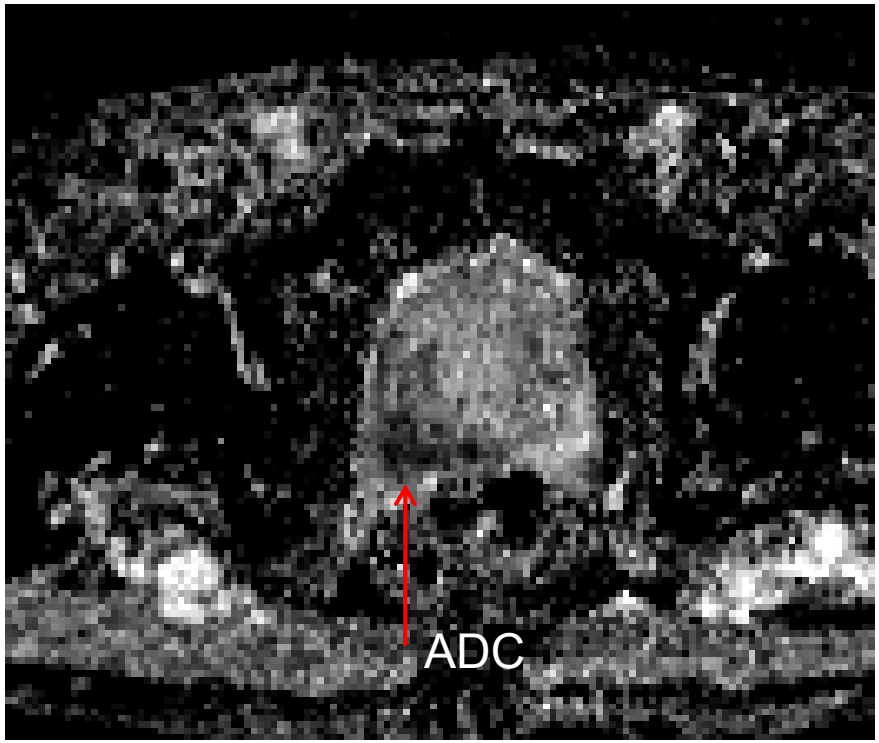

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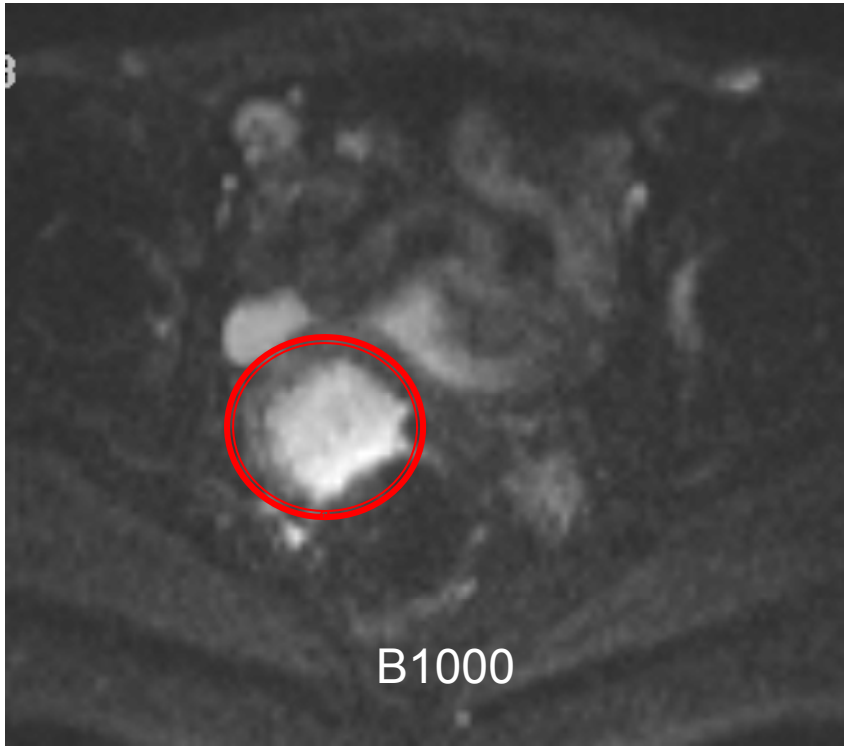

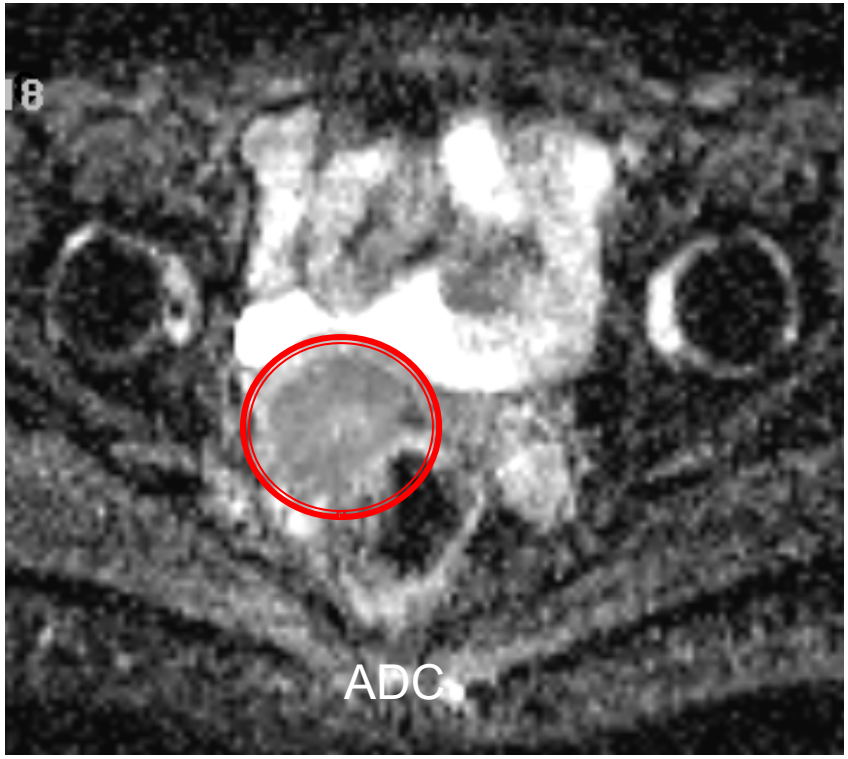

Key points

- DWI can be used for lesion detection and also for lesion characterization
  - There are caveats…
    - Poor signal to noise
    - Magnetic susceptibility
    - DWI cannot always reliably distinguish between malignant and benign solid visceral lesions
    - Hemorrhage, normal tissue (premenopausal endometrium) can demonstrate restricted diffusion
  - Use all of the sequences…DWI should complement and not replace your standard body/pelvic MR sequences