

Multiparametric MR Enterography Without the Use of Antiperistaltic Agents: Performance and Interpretation

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PURPOSE

To describe how to perform and interpret MR enterography (MRE) without using antiperistaltic agents.

MRE WITHOUT ANTIPERISTALTIC AGENTS

- High sensitivity (85%) and specificity (80%) for the evaluation of Crohn's disease, similar to studies of MRE with antipersaltics.¹
- High diagnostic confidence, substantial inter-reader agreement and similar results as CT enterography²

Advantages:

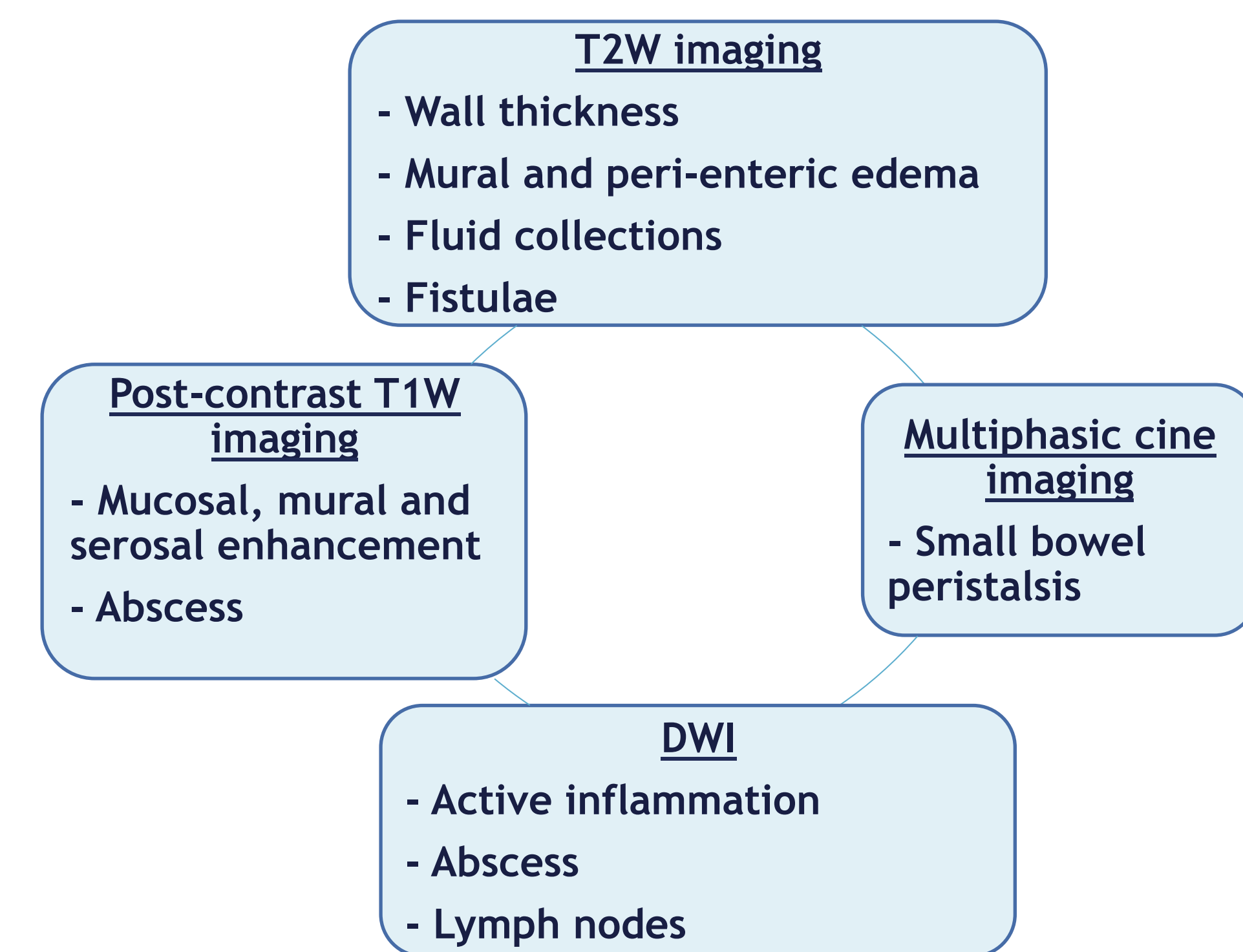
- Lower cost, avoidance of side effects, less interruption in work-flow for injections, less complex patient screening for potential contraindications, decreased exam time

Limitation:

- Motion artifact on 3D gradient echo (GRE) sequences

INTERPRETATION: MULTIPARAMETRIC APPROACH

- Motion artifact can be overcome by using a multiparametric approach for interpretation
- T2W images and dynamic post-contrast T1W images have traditionally been relied upon for small bowel evaluation²
- Diffusion-weighted imaging (DWI) and a multiphase cine sequence are less frequently utilized,³ but are valuable supplementary sequences



SAMPLE PROTOCOL

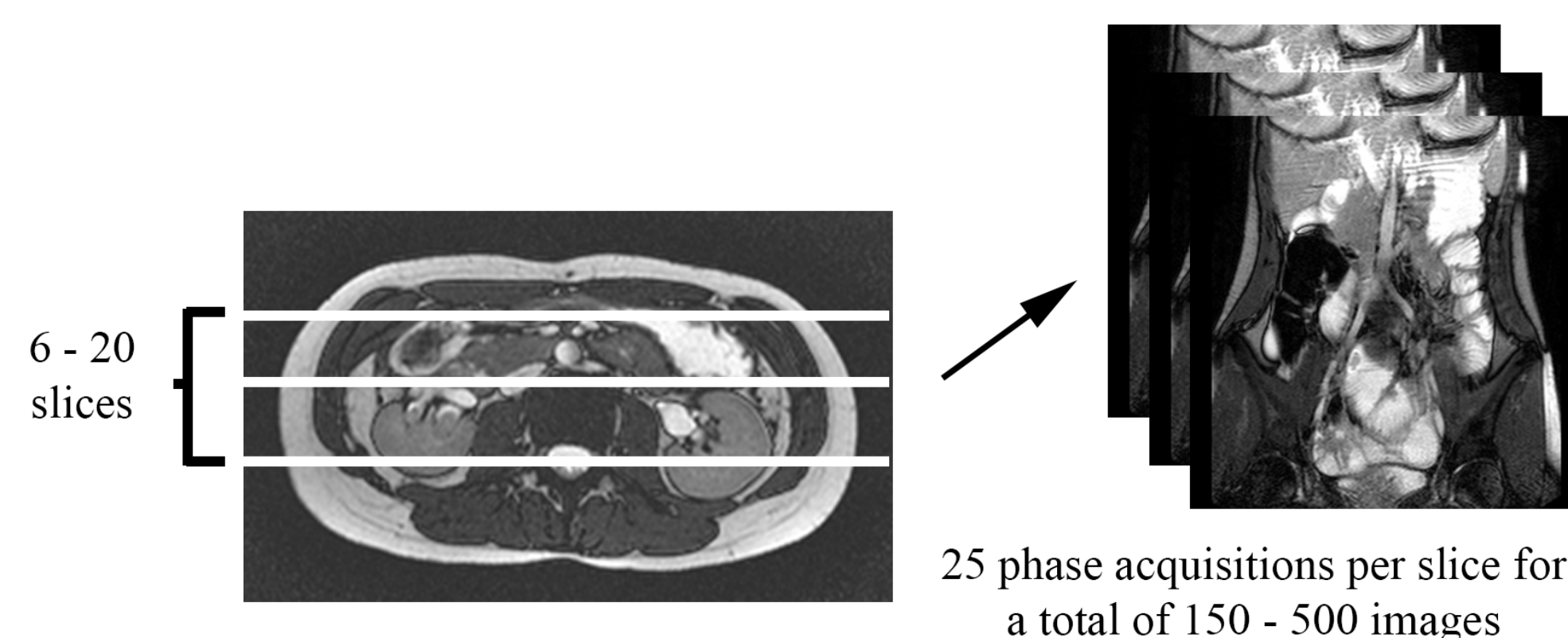
Balanced SSFP survey (BFFE, TrueFISP, SSFSE)	Coronal & axial moderately T2W (SPAIR-SS TSE, STIR Navigator, FRFSE)
Coronal & axial heavily T2W (SS-TSE, HASTE, SSFSE)	Coronal & axial delayed post-contrast FS 3D GRE (THRIVE, VIBE, LAVA)
Coronal dual gradient echo	Axial diffusion-weighted
Coronal pre- and dynamic post-contrast FS 3D GRE (THRIVE, VIBE, LAVA)	Coronal cine BSSFP (BFFE, TrueFISP, FIESTA)

REFERENCES:

1. Grand DJ et al. Eur J Radiol 2012;81:e763-9.
2. Grand DJ et al. Eur J Radiol 2012;81:1735-41.
3. Ziech MLW et al. Eur J Radiol 2012;81:e467-72.
4. Froelich JM et al. Eur J Radiol 2010;8:1945-51.
5. Oto A et al. Acad Radiol 2009;16:597-603.
6. Ream JM et al. Pediatr Radiol 2013;43:1077-85.

CINE BALANCED STEADY STATE FREE PRECESSION (BSSFP)

- Evaluates bowel motility, functional disorders, adhesions
- Distinguishes luminal narrowing from stricture or active inflammation from temporary contraction
- May increase sensitivity of lesion detection in Crohn's disease compared to static MRE⁴
- Segmental abnormal motility on cine images corresponds to morphologic abnormalities on static images
- Does not require additional patient preparation or special software
- Acquisition time: 4 minutes or less
- Temporal resolution: 0.6 seconds



Slice thickness	5-8 mm	# Signal averages	0.75-1
Intersection gap	1-1.5 mm	Flip angle	45-70 degrees
# Slices	6-20	TR	3.3-5.12 msec
Phases/Slice	25	TE	1.63-2.28 msec
Total # Images	150-500	Bandwidth	83-1136
Field of view	340-500 mm	* Variations based on MR vendor	
Matrix size	176 x 178 - 360 x 320		

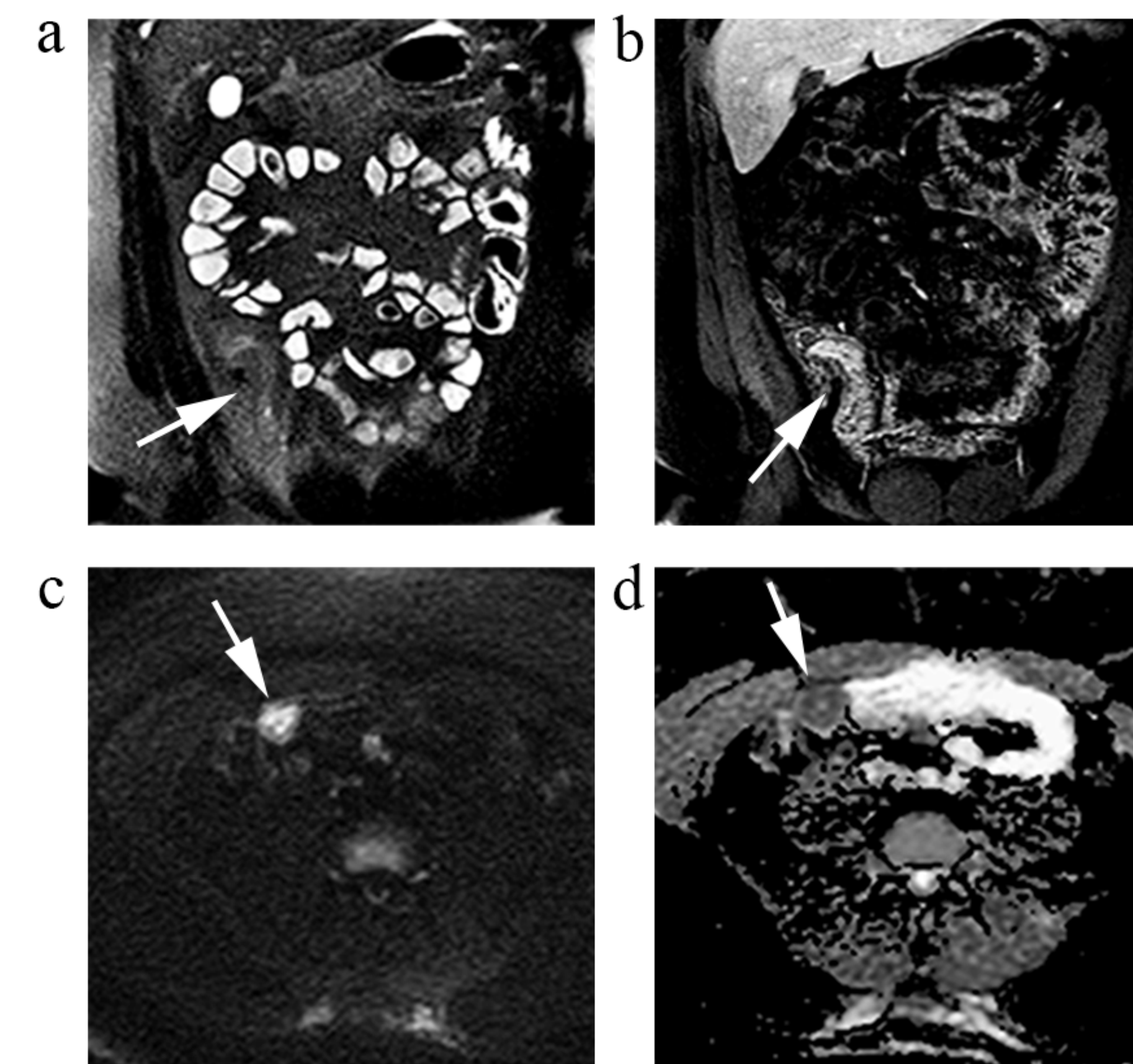
DIFFUSION-WEIGHTED IMAGING

- Diffusion restriction corresponds to areas of active inflammation^{5,6}
- Abscesses and lymph nodes are more conspicuous on DWI

SUMMARY

- There are advantages to performing MRE without antiperistaltics, most notably decreased cost and fewer side effects and contraindications
- No study has shown the diagnostic necessity of antiperistaltic agents
- The major limitation of MRE without antiperistaltics, motion artifact on 3D GRE sequences, may be minimized by utilizing a multiparametric approach
- Diffusion-weighted imaging and a multiphase cine sequence are supplements to T2- and dynamic post-contrast T1-weighted images
- With practice and by using multiple pulse sequences, interpretation of MRE without antiperistaltic agents can be as accurate as MRE with antiperistaltic agents

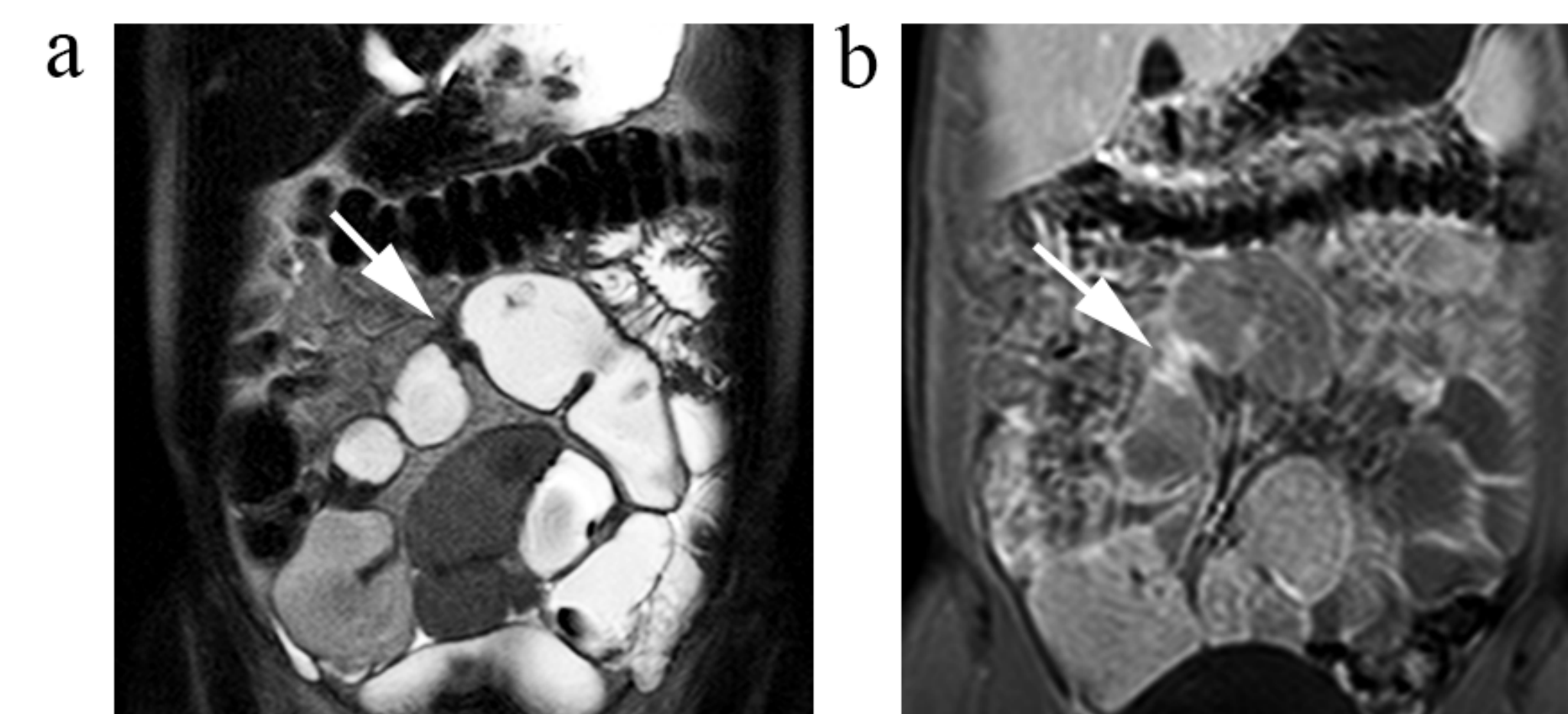
SAMPLE CASE 1



Fat-suppressed (FS) T2W image (a) shows mural edema (arrow) involving the terminal ileum in a 20-year-old male patient with Crohn's disease. Post-contrast FS 3D GRE T1W image obtained in the arterial phase (b) shows mucosal hyperenhancement (arrow). Associated diffusion restriction with hyperintense signal (arrow) on DWI (c, b = 800 mm/s²) and hypointense signal (arrow) on the ADC map (d). Findings are compatible with active inflammation. See <http://www.mri.tju.edu/CTMRI/ISMRM/Case-1.gif> (or scan code) for the cine BSSFP sequence, showing hyperperistalsis of the affected terminal ileum compared to other normal bowel segments.



SAMPLE CASE 2



FS T2W image (a) shows a short segment of hypointense, thickened and narrowed bowel (arrow) in an 18-year-old male with a history of fibrostenotic Crohn's disease. Note the upstream small bowel dilatation. The delayed post-contrast FS 3D GRE T1W image (b) shows enhancement. See <http://www.mri.tju.edu/CTMRI/ISMRM/Case-2.gif> (or scan code) for the cine BSSFP sequence. The segment of luminal narrowing is fixed, confirming the presence of a stricture. The cine sequence is helpful to evaluate strictures, which remain fixed during peristalsis, compared to a contracting or under-distended segment, which will change morphology.

