

Use of Abdominal Imaging to Guide the Diagnosis and Management of IBD

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Disclosures

- Matthew Hamilton-
 - Education/Training- Abbvie, Johnson and Johnson
 - Advising- Johnson and Johnson, Odyssey
- Avneesh Gupta-
 - No disclosures

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Learning Objectives

- To review abdominal imaging findings to assist in the diagnosis and management of ulcerative colitis
- To understand use of abdominal imaging for the diagnosis and management of Crohn's including luminal complications and peri-anal disease

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Outline

- Brief overview of commonly used abdominal imaging techniques with strengths and limitations
- Patient Case (new diagnosis UC)
- Patient Case (active luminal disease with stricture in Crohn's)
- Patient Case (complex peri-anal disease in Crohn's)
- Summary

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Overview of Imaging

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CT Enterography

- Takes a few seconds
- IV and PO contrast



MR Enterography

- Takes 30-45 minutes
- Loud
- Surface coil worn by patient
- IV and PO contrast

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CT offers rapid, high-resolution imaging

CTE ADVANTAGES & HIGH-VALUE USES

- **Sub-Millimeter Spatial Resolution**
- **Speed & Motion Resistance:** Scan acquisition is completed in <10 seconds
- **Emergency Accessibility:** Available 24/7 in emergency rooms.

CTE LIMITATIONS & CLINICAL PITFALLS

- **Ionizing Radiation Risk**
- **Inferior Tissue Contrast:** Fails to match MRI's contrast resolution for subtle bowel wall edema. Early, low-grade active inflammation can be entirely missed on CTE.
- **Iodinated Contrast Risks:** Requires IV iodinated contrast, posing risks of hypersensitivity or contrast-induced nephropathy (CIN) in patients with baseline renal impairment.

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A standard CTE increases lifetime cancer risk by 0.1%, but cumulative exposure is the true hazard

RADIATION DOSES IN CONTEXT

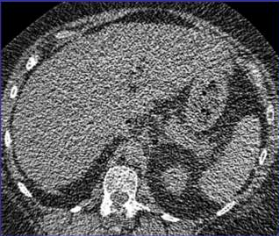
- **Annual Natural Background**
3.0 mSv (Naturally received cosmic radiation)
- **Chest X-Ray (CXR)**
0.1 mSv (12 days of background radiation)
- **Standard CT Enterography**
10.0 mSv (100 CXRs, 3.3 years of background radiation)
 - Ultra low-dose CT using AI can reduce this to <2 mSv
- Chronic Crohn's patients may get multiple CTEs
>50.0 mSv

TRANSLATING CANCER RISKS

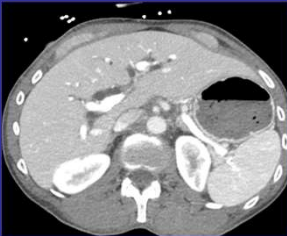
- **Absolute Lifetime Risk of a fatal radiation-induced cancer from 1 Standard CTE:** increases ~0.1%
- **Baseline Context for Patients:** Lifetime risk of developing cancer in the general population is already ~40%. A single CTE shifts this absolute risk from 40.0% to 40.1%
- **The Cumulative Threat:** Due to repeated flares, 10% to 34% of Crohn's disease patients receive a cumulative effective dose of >50 mSv over their lifetime. This raises their absolute cancer risk by ~0.5% (a 1 in 200 hazard).
- **Pediatric and young female patients are 3-4x more sensitive** to radiation-induced carcinogenesis than older adults
- **Ultra low-dose CT (AI):** drops effective doses to <2.0 mSv, reducing the lifetime cancer risk by 75%+ (to ~1 in 5,000).

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Caveat – Ultra low-dose CT images may be low quality



Low dose



Normal dose

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MRE delivers superior soft-tissue characterization compared to CT

MRE ADVANTAGES & HIGH-VALUE USES

- **Zero Ionizing Radiation:** Ideal for serial therapeutic monitoring in children and young adults.
- **Superb Tissue Contrast:** Better detection of bowel wall edema and subtle enhancement.
- **Dynamic Cine Motility:** Coronal cine sequences monitor real-time bowel contraction.

MRE LIMITATIONS & CLINICAL PITFALLS

- **Vulnerability to Motion Blur:** Long scan times (30-45 minutes) leave images highly susceptible to peristalsis and breathing blur.
- **Operational Barriers:** Significantly more expensive and less available than CT, requires specialized high-field magnets (1.5T/3T), long wait times, and high expert interpreter demands.
- **Claustrophobia & Tolerance:** Many acutely ill or claustrophobic patients cannot tolerate the tight magnet bore and repeated, prolonged breath-holds.

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Imaging findings of active vs. chronic Crohn's disease

DIAGNOSTIC CRITERIA: ACTIVE VS. CHRONIC

Active Inflammatory Disease

- Wall thickening (>3mm)
- Marked stratified mucosal hyperenhancement
- Wall edema
- Vasa recta engorgement ("Comb sign")

Chronic / Fibrostenotic Disease

- Submucosal fat-containing wall deposition
- Wall fibrosis
- Mild enhancement
- Absence of surrounding inflammatory stranding.

SIMPLIFIED MaRIA (sMaRIA) SCORING

sMaRIA Point Distribution (Calculated per Segment):

- Wall Thickness >3mm = 1 point
- Mural Edema (T2/STIR) = 1 point
- Fat Stranding (perienteric) = 1 point
- Deep Ulceration = 2 points

Validated Actionable Cutoffs:

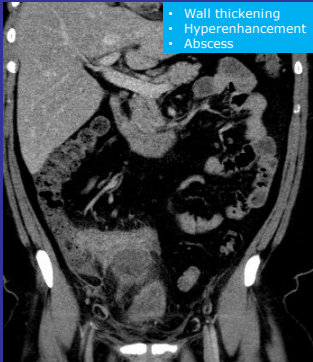
- sMaRIA score ≥ 1: Indicates Active Crohn's Disease
- sMaRIA score ≥ 2: Indicates Severe Active Disease

Strong Clinical Correlation: Highly validated against endoscopic findings (SES-CD) and fecal calprotectin. Excellent for tracking objective mucosal healing during treatment monitoring.

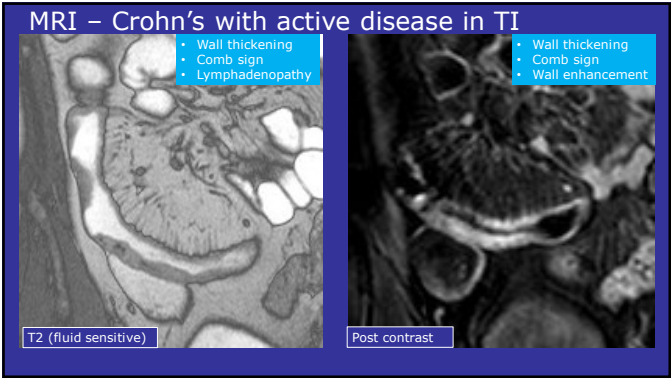
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CT

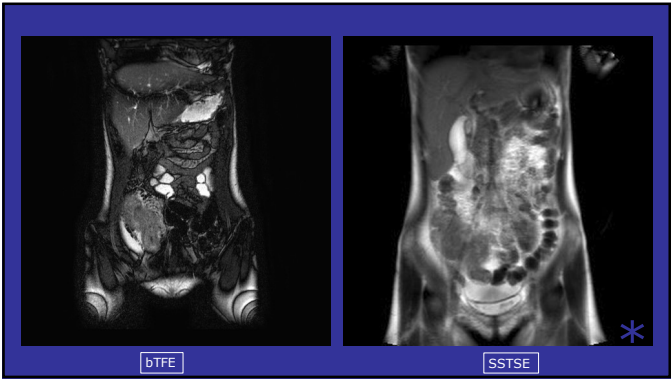
Crohn's with active disease in TI



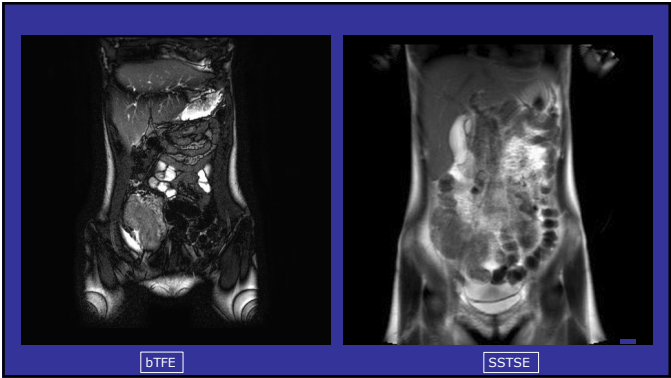
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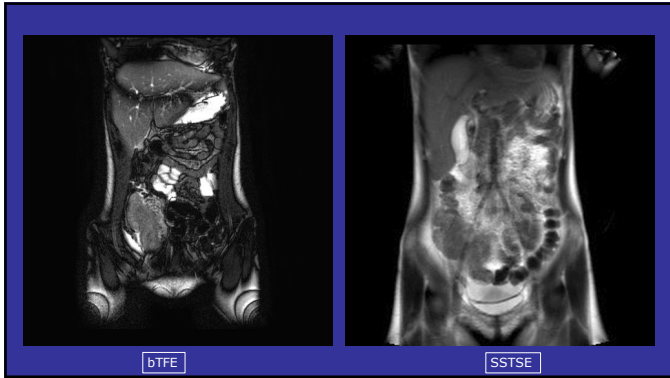
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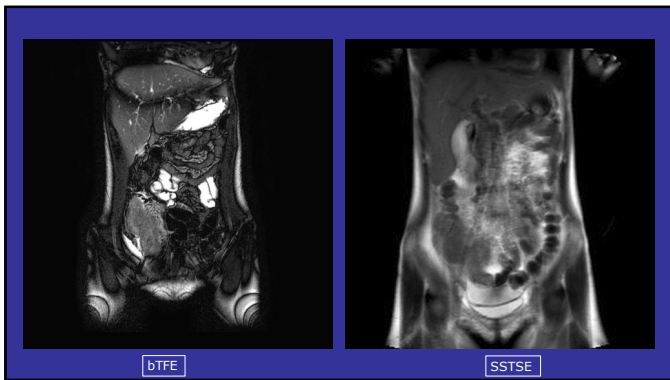
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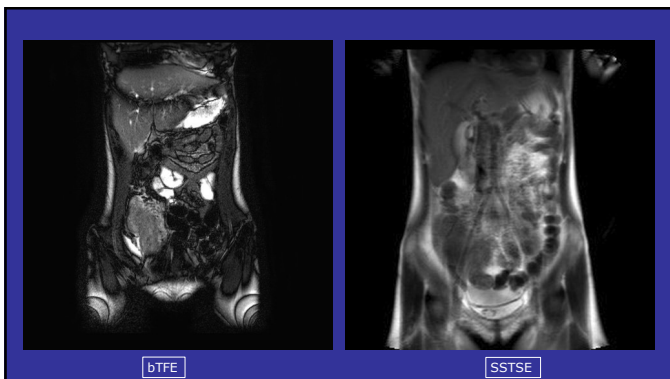
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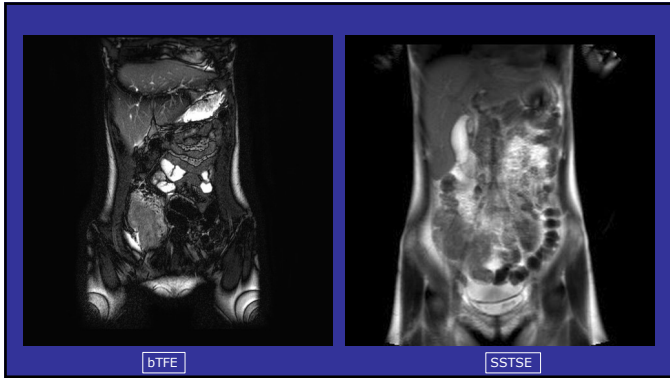
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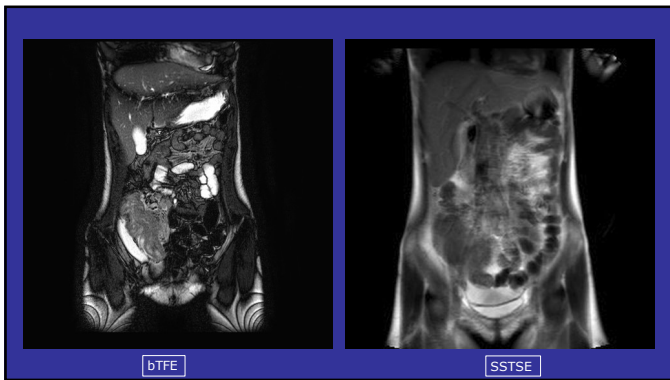
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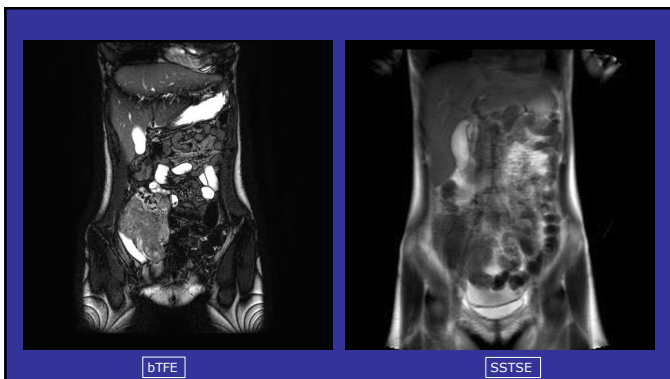
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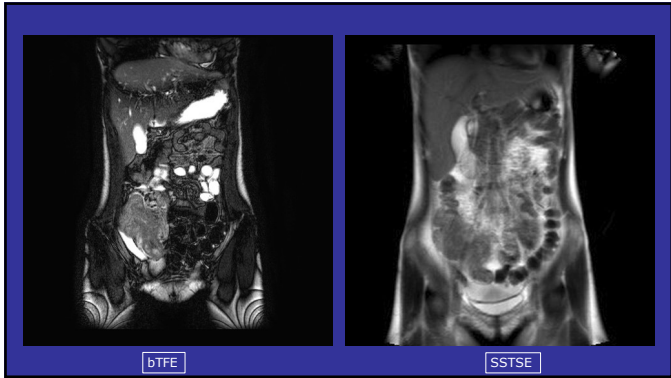
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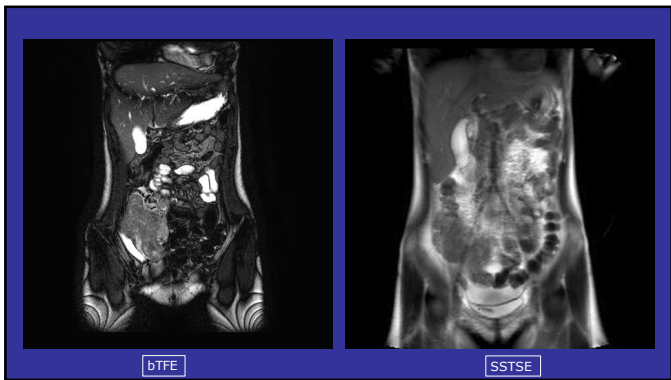
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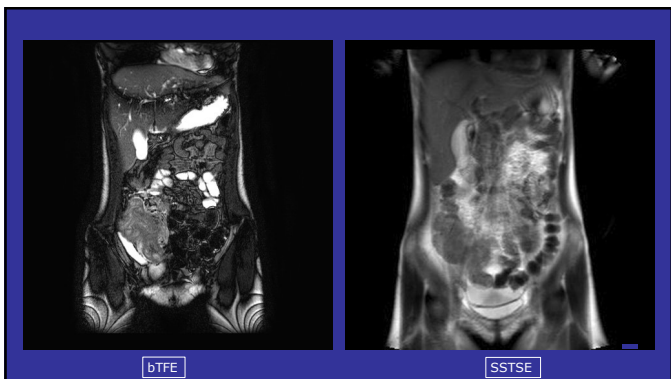
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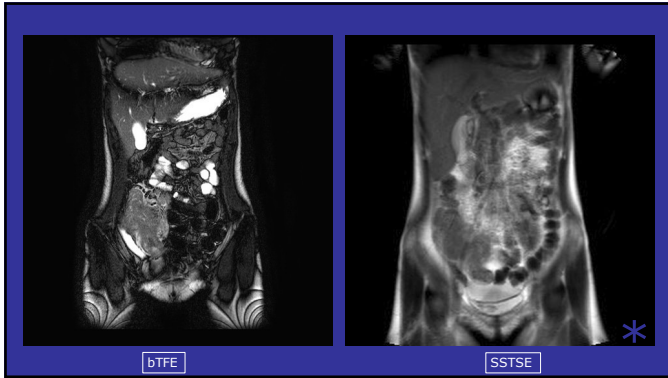
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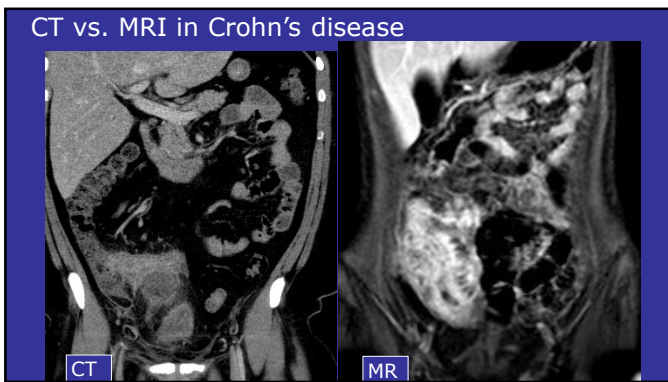
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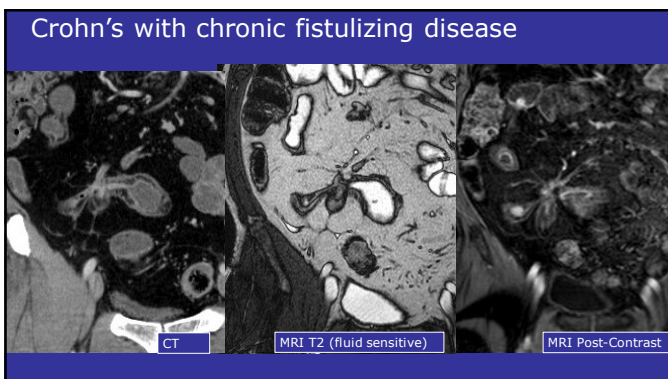
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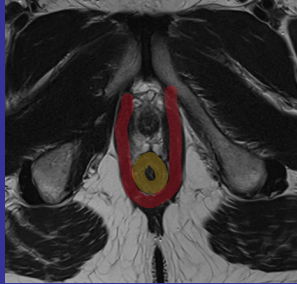


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Pelvic MRI maps sphincter anatomy and tracks complex fistulizing disease

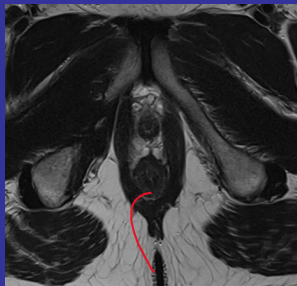
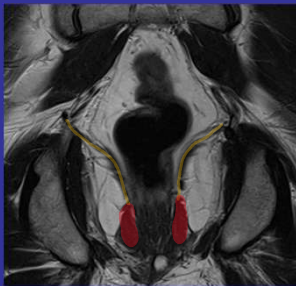
PELVIC MRI: KEY ADVANTAGES & PROTOCOLS

- **The Sphincter Gold Standard:** Internal and external anal sphincters
- **High-Resolution Sequences**
- **Contrast for Abscesses**
- **Therapeutic Monitoring:** Tracks healing and closure of tracts in response to treatment



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Pelvic MRI maps sphincter anatomy and tracks complex fistulizing disease



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Case 1 new onset colitis

- 34 y o male with several weeks of loose stools mixed with some blood and fecal urgency.
- Admitted to hospital with worsening of bowel symptoms, weight loss, palpitations
- WBC 22, Hg 10.9, albumin 2.6, CRP 105, calprotectin 5500. Stool infectious studies all negative
- CT abdomen from ED

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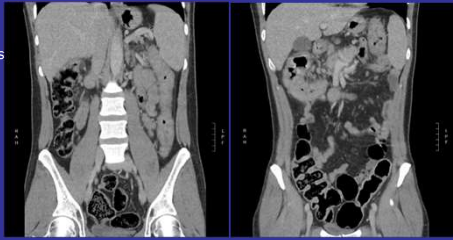
CT**Abdomen/Pelvis**

Is there colitis? If so, what is extent? Acute vs chronic?

Small bowel or peri-anal involvement ?

Any complications or other visualized process?

- Perforation
- Other process (malignancy)



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Case 2 Crohn's with SBO

- 26 y o male with long standing ileal-colonic CD maintained on infliximab
- Previous colonoscopy showed mild to moderate inflammatory changes in the ileum to 15 cm from the ICV. No overt stricture
- One year later presented to ED with RLQ pain and vomiting and found to have a partial SBO at level of terminal ileum

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CT**Abdomen/Pelvis**

Any acute and chronic features of inflammation?

Is there a stricture or any other complications?

Would you recommend an MR enterography and if so, when?



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Case 3 Crohn's with peri-anal pain

- 42 y o male diagnosed at OSH with UC proctosigmoiditis when developed fecal urgency, rectal bleeding
- Limited response to steroids and oral mesalamine and Vedolizumab started
- Developed fullness and pain in anal area and presented to ER. Temp 100.4

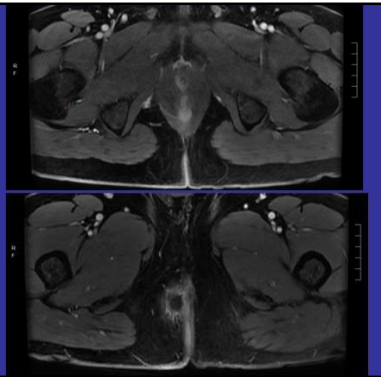
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MRI Pelvis

Is there a fistula? If so, what is extent? Acute vs chronic?

Any complications or other visualized process?

- Abscess- ?drainable
- Other process (malignancy)



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Summary- Cross sectional Imaging in IBD

- At diagnosis
 - UC- disease extent, complications **CT**
 - Crohn's- extent of disease including small bowel and phenotype, perianal, complications **CTE=MRE**
- Management of IBD- assessment of luminal complications, response to therapy **MRE**
- Peri-anal complications- **MRI Pelvis**

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AGA Guidelines- Radiology in IBD

Table 4. Recommendations for Use of Computed Tomography or Magnetic Resonance Enterography, and Incorporation of Imaging Findings Into the Clinical Report

Recommendations
1. Radiologists should indicate that inflammatory small bowel Crohn's disease is likely when either (i) in known Crohn's patients when mural hyperenhancement and wall thickening are present, or (ii) when enteric inflammation is asymmetric or co-exists with the typical penetrating complications of Crohn's disease. (Strong)
2. Radiologists should report the number of involved bowel segments, approximate location (proximity to ileocecal valve or ligament of Treitz), length and degree of upstream dilation of Crohn's strictures so that gastroenterologists and surgeons can decide on the best therapeutic option and approach. (Strong)
3. When describing bowel loops having a Crohn's stricture or penetrating disease (sinus tract, abscess or enteric fistula), radiologists should state if imaging findings of mural inflammation are present. (Strong)
4. Cross-sectional enterography should be performed at diagnosis of Crohn's disease to detect small bowel inflammation and penetrating complications beyond the reach of standard fecalocolonoscopy. (Strong)
5. Cross-sectional enterography should be considered in disease monitoring paradigms when small bowel disease or penetrating disease complications are present. (Strong)
6. Dedicated pelvic MRI (perianal fistula MRI imaging protocol) is required for the adequate prescriptive assessment of perianal Crohn's disease and its complications (number of fistula tracts, location and relationship to anal sphincter muscle complex, and presence of abscesses), but every CTE or MRE should image the anus, and radiologists should comment if findings suspicious for perianal disease (fistula or abscess) are present. (Strong)
7. Because intramural T2 hyperintensity, restricted diffusion, per-enteric stranding, wall thickness and mural ulcerations seen at cross-sectional enterography generally correlate with severity of endoscopic and histologic inflammation, radiologists should comment on these findings and describe them when present. (Strong)
8. MRE should be used rather than CTE, when possible, for estimating response to medical treatment in asymptomatic Crohn's disease, as its multiparametric nature permits evaluation of multiple imaging parameters that reflect inflammation and avoids radiation. (Weak)
9. If cross-sectional enterography is indicated and intravenous contrast cannot be administered, noncontrast MRE with T2-weighted and diffusion-weighted imaging should be used as acceptable alternative. (Weak)
10. CTE and MRE exams should be carefully evaluated for evidence of mesenteric venous thromboses or occlusions and small bowel varices. (Strong)

*Strong recommendation indicates confidence that the desirable effects of the test or interpretation will result in a positive impact on patient care.
*Weak recommendation indicates that uncertainty exists relating to the positive and negative impacts on patient care.

Bruining D et al., Gastro 2018
