



GI RADIOLOGY UPDATE

ASEP 13TH ANNUAL ENDOSCOPY SKILLS DAY

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No additional financial disclosures

GI
RADIOLOGY
UPDATE



GI RADIOLOGY UPDATE

- ▶ UGI Fluoroscopic Studies (yes, we still do these!)
 - ▶ CT/MR Enterography
 - ▶ Imaging of GI Bleed
 - ▶ CT Colonography
 - ▶ GI Scintigraphy for bowel motility
-
- ▶ Will discuss: Indications, Techniques, Advantages/Limitations

UGI FLUOROSCOPY

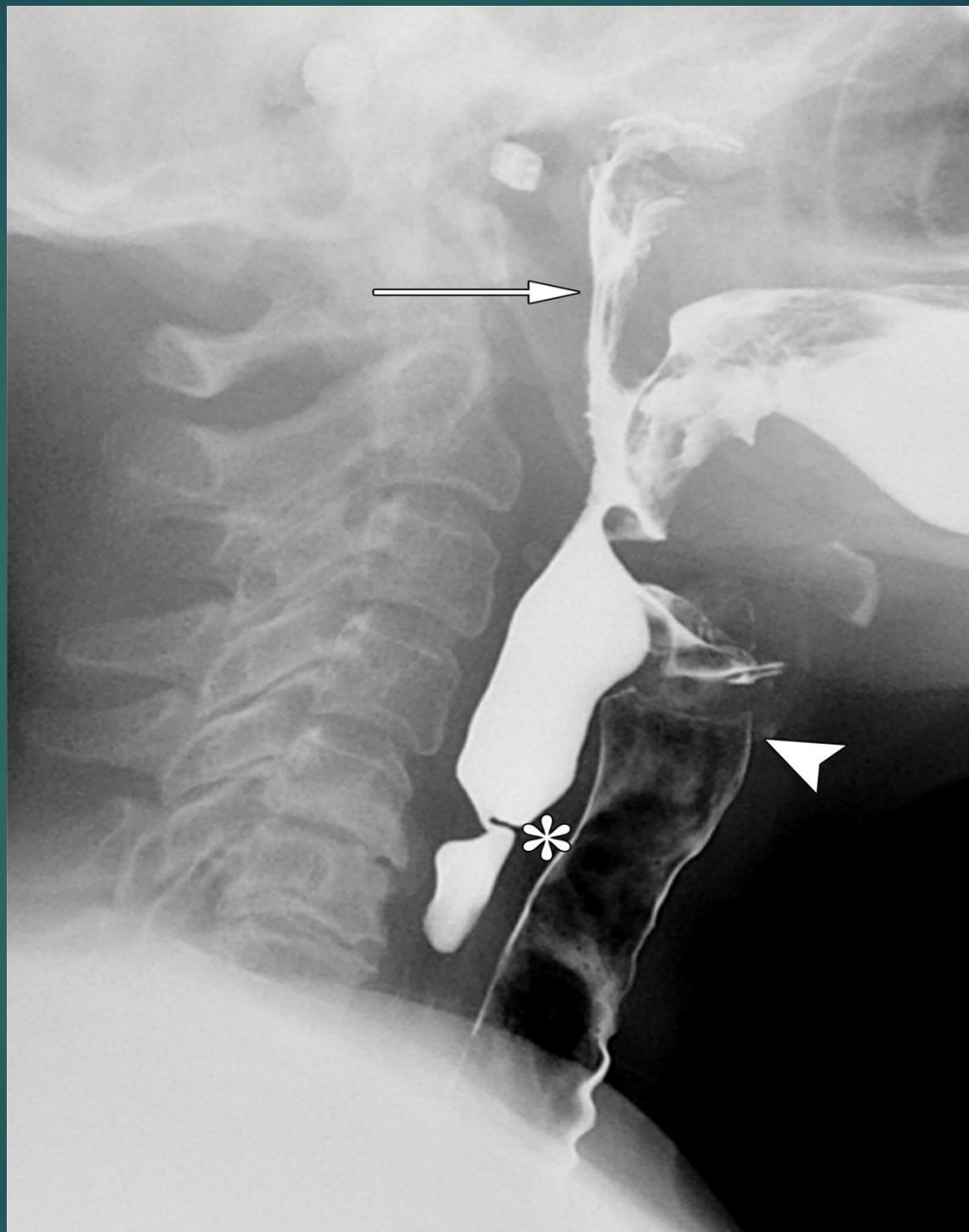
- ▶ Indications:
 - ▶ Dysphagia, aspiration
 - ▶ Esophageal dysmotility, vomiting
 - ▶ GERD, Peptic ulcer disease, Hiatal hernia, unspecified abdominal/chest pain (awaiting endoscopy or other imaging)
 - ▶ Post-op
 - ▶ Bariatric surgery, esophagectomy, gastrectomy

OROPHARYNGEAL DYSPHAGIA

- ▶ 20% of the general population
- ▶ 50% of nursing home population
 - ▶ Increased risk of aspiration
- ▶ Fluoroscopic swallowing study is the most common imaging modality to assess deglutition disorders
- ▶ Includes anatomic and functional information

MODIFIED BARIUM SWALLOW

- ▶ Technique
 - ▶ Patient upright/seated
 - ▶ Lateral position
 - ▶ Image with video fluoroscopy
 - ▶ Study performed with variable viscosity material coated with barium



Anatomic Abnormalities



Esophageal
web



Radiation
stricture



Cervical
esophageal tumor



Zenker
diverticulum



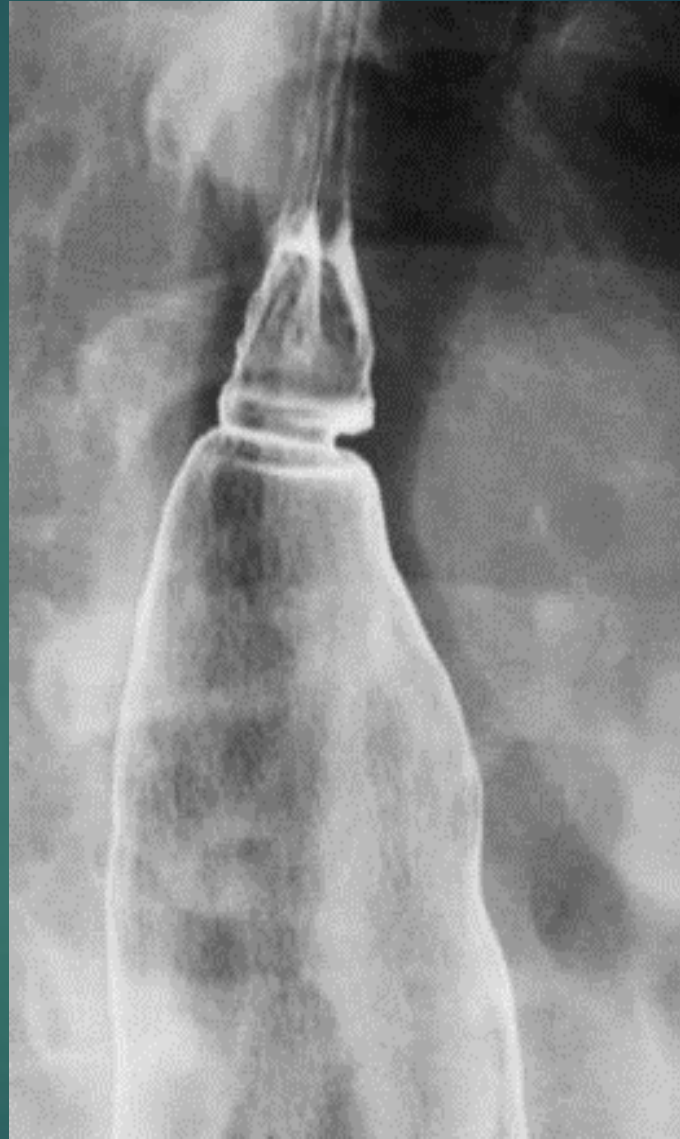
Pseudo-Zenker
diverticulum

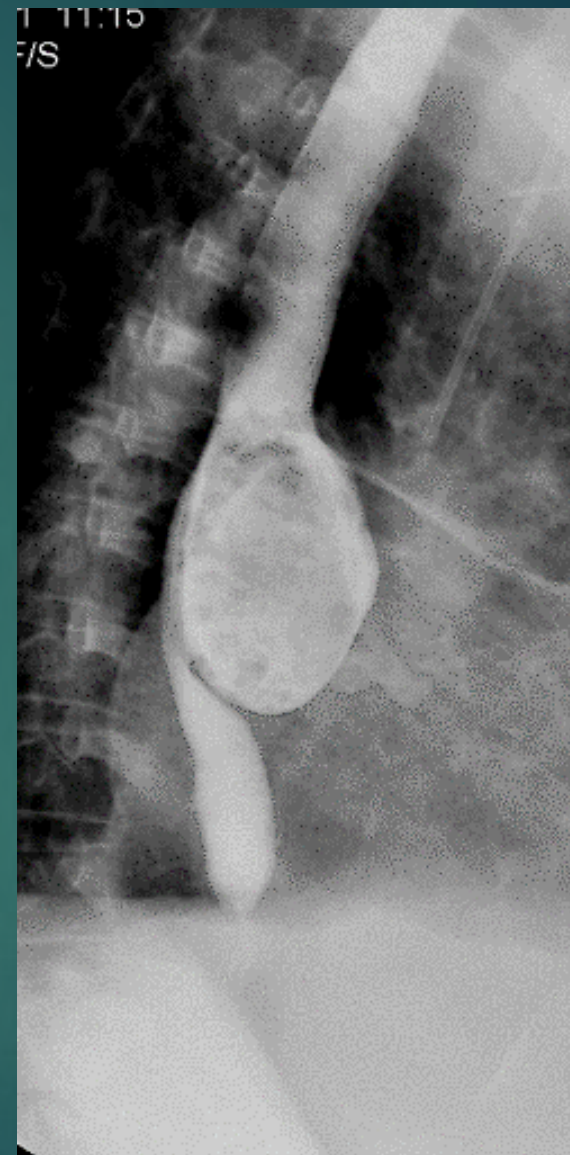


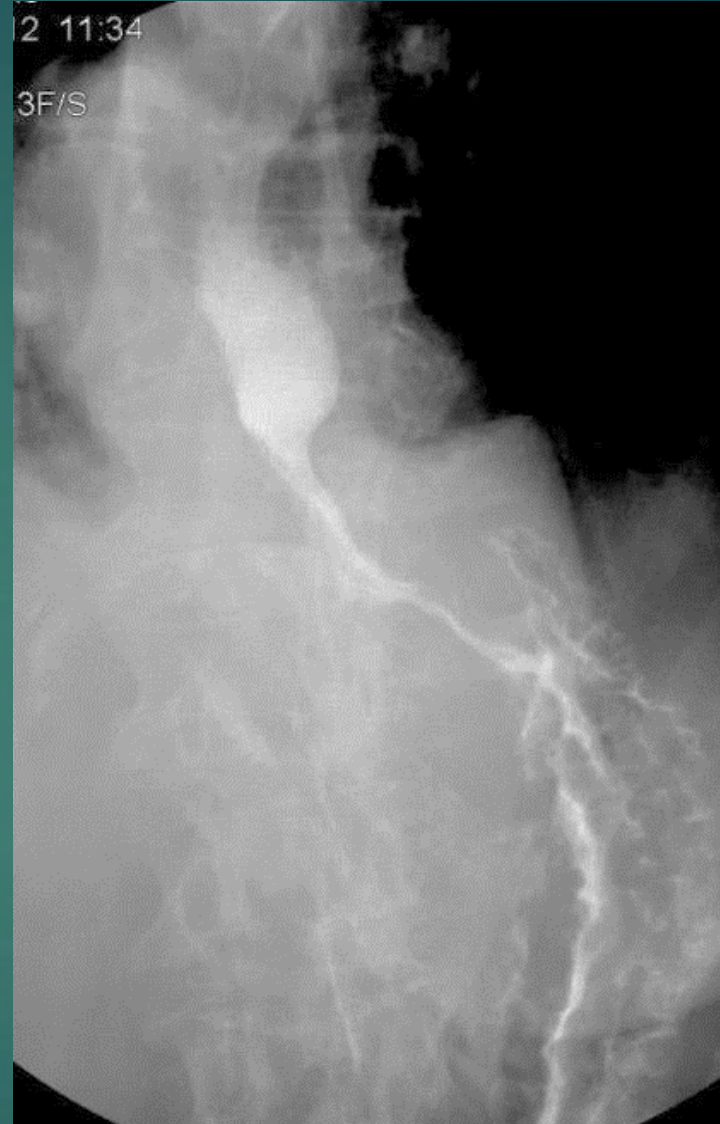
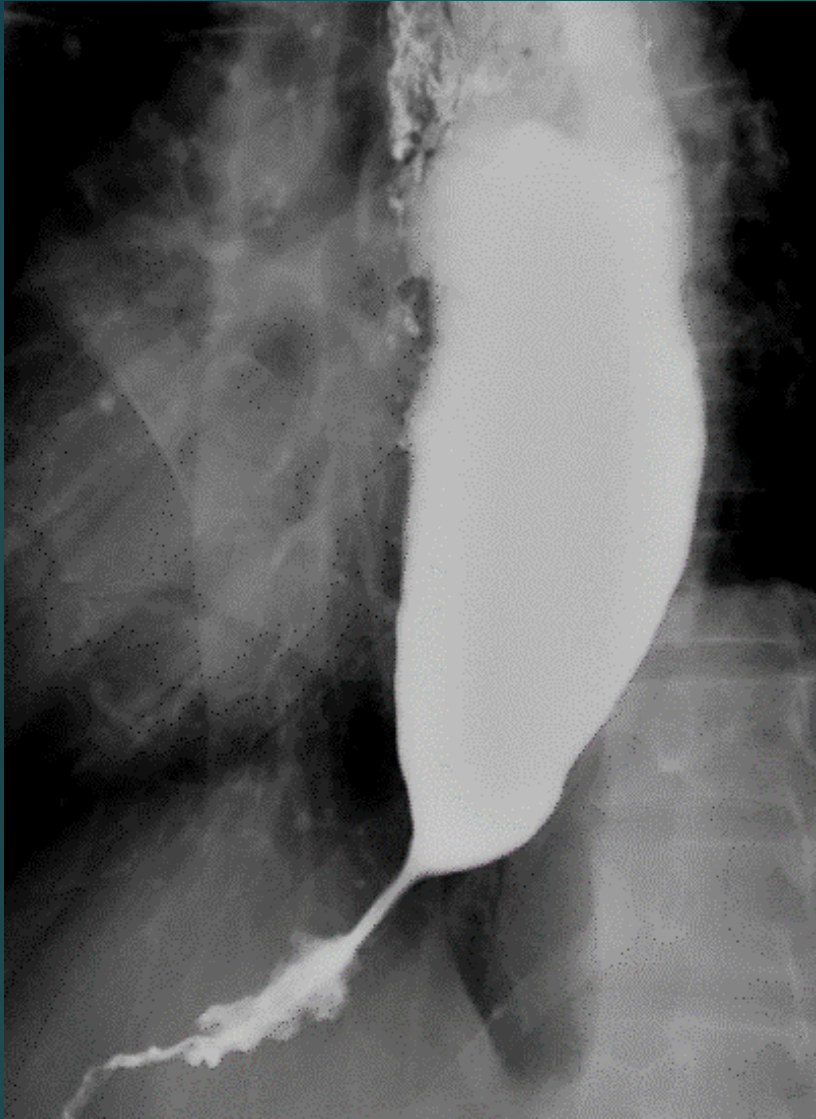
Killian-
Jamieson
diverticulum

BARIUM ESOPHAGRAM

- ▶ Single/double contrast imaging of the entire esophagus
 - ▶ For double contrast, patient ingests effervescent granules to distend lumen – allows for better assessment of the mucosa
 - ▶ Double contrast limited to ambulatory patients



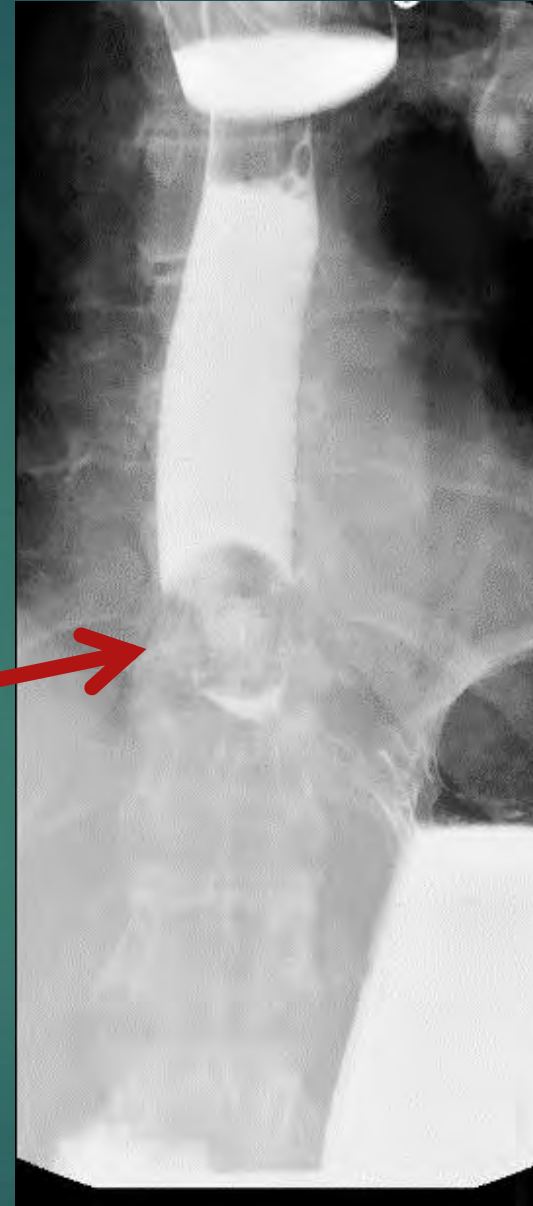




Why bother with an Esophagram?

- ▶ Apart from easy access to imaging, most pathology is noted at the time of endoscopy
- ▶ Fluoroscopic evaluation adds functional assessment
 - ▶ Correlation with site of symptoms
 - ▶ Correlation with cause of symptoms
 - ▶ Evaluation of bolus transit

For dysphagia
with solids,
give a solid bolus

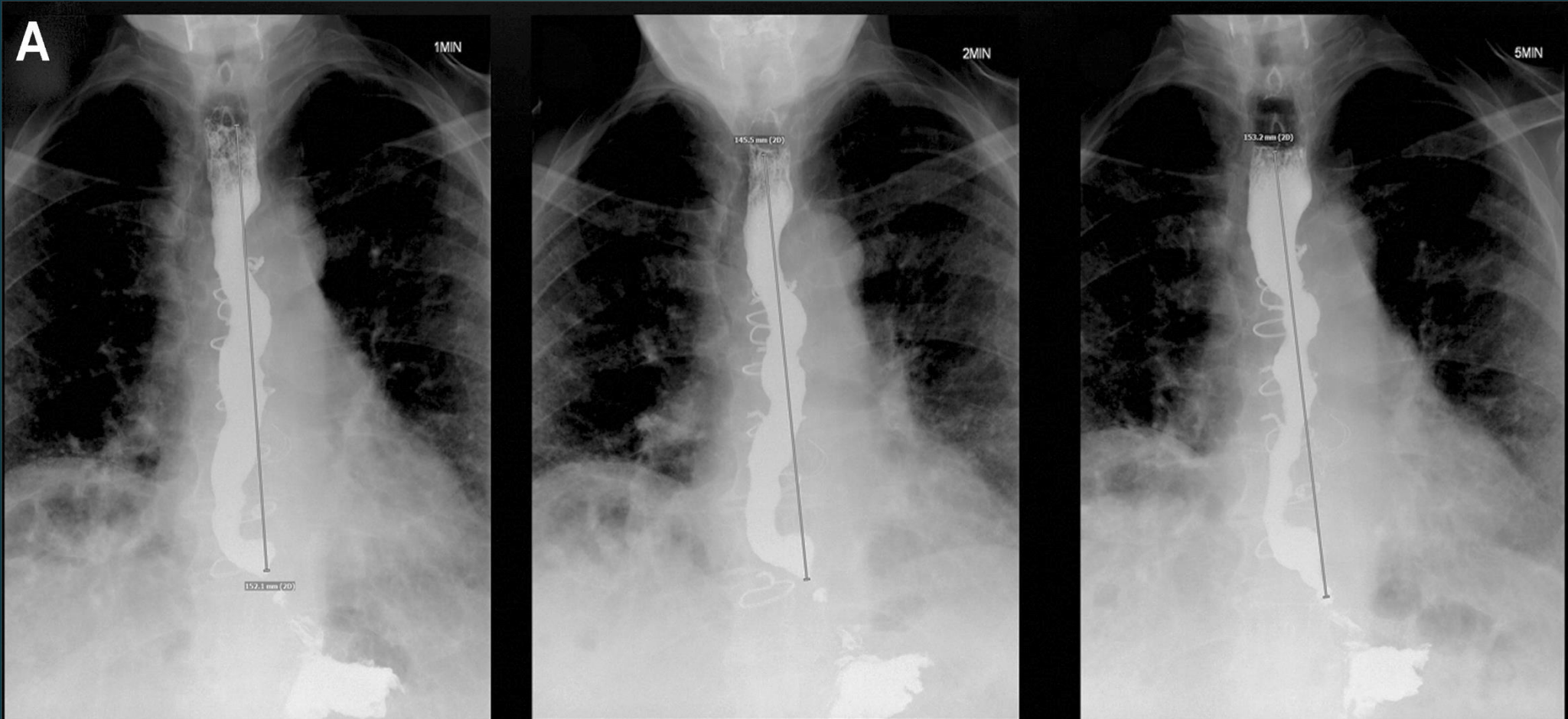


ESOPHAGEAL DYSMOTILITY

- ▶ Esophageal emptying can be assessed with a timed esophagram
- ▶ Indication:
 - ▶ pre- or post-intervention study for achalasia
 - ▶ Could use for other causes of stricture

ESOPHAGEAL DYSMOTILITY

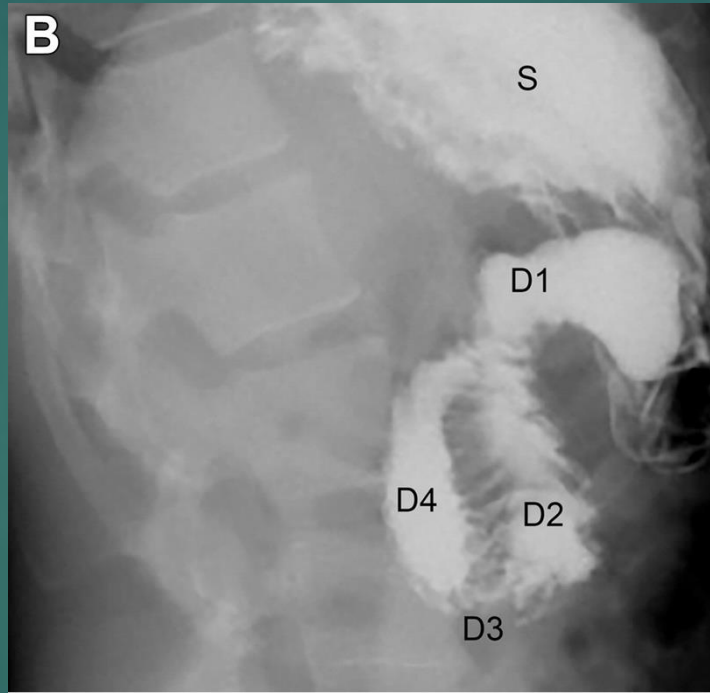
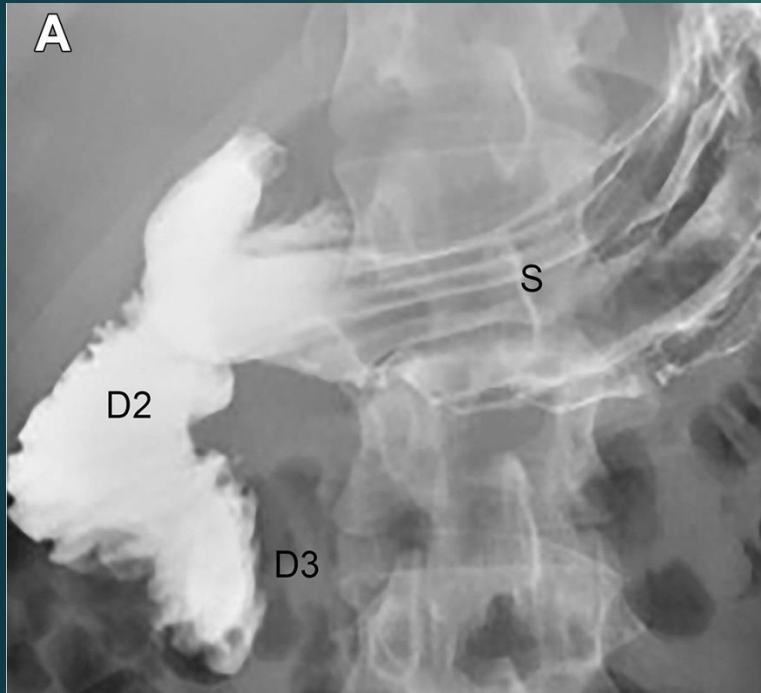
- ▶ Technique
 - ▶ Patient ingests barium liquid while in an upright position
 - ▶ Images obtained immediately after ingestion, at 1 minute, 2 minutes and 5 minutes
 - ▶ Retained barium column at each point in time measured to assess rate of emptying



UGI FLUOROSCOPY

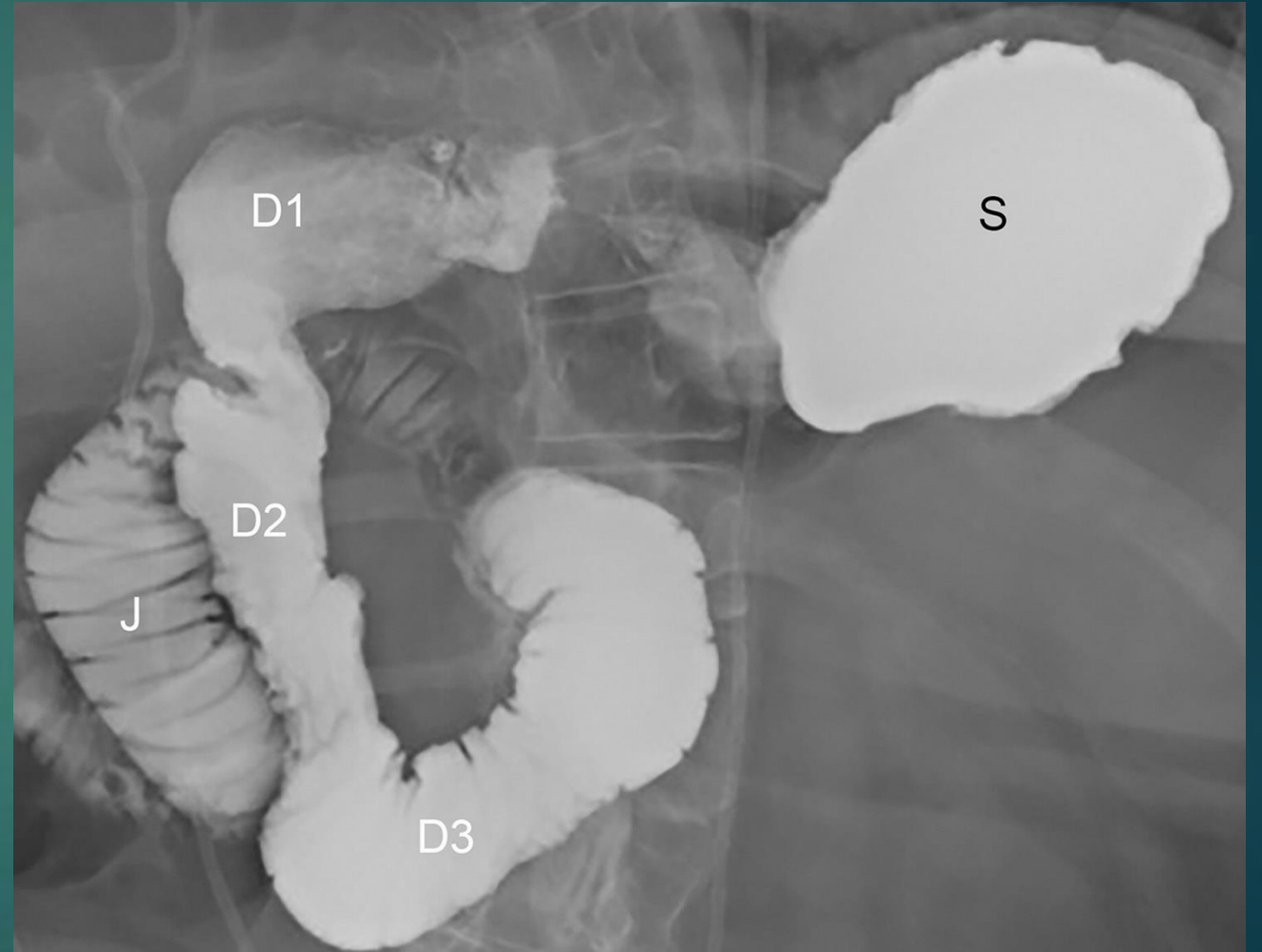
- ▶ Endoluminal and extraluminal abnormalities of stomach and duodenum well assessed by endoscopy, CT and MR
- ▶ Fluoroscopy may be helpful for functional information
 - ▶ transit through lumen, spasm

SMA SYNDROME



21-year-old female with
chronic abdominal pain

Abnormal course of the
fourth part of the
duodenum due to
malrotation

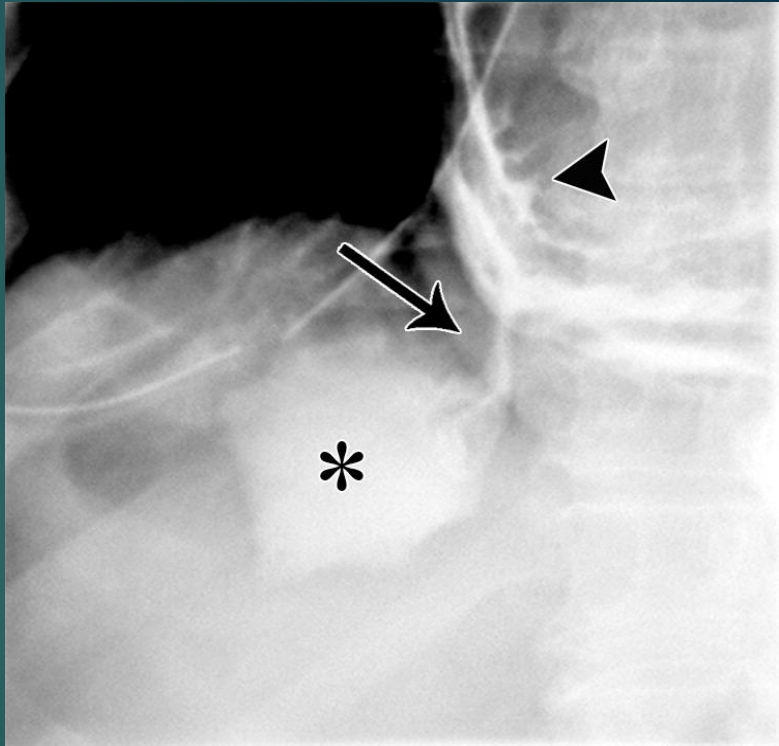
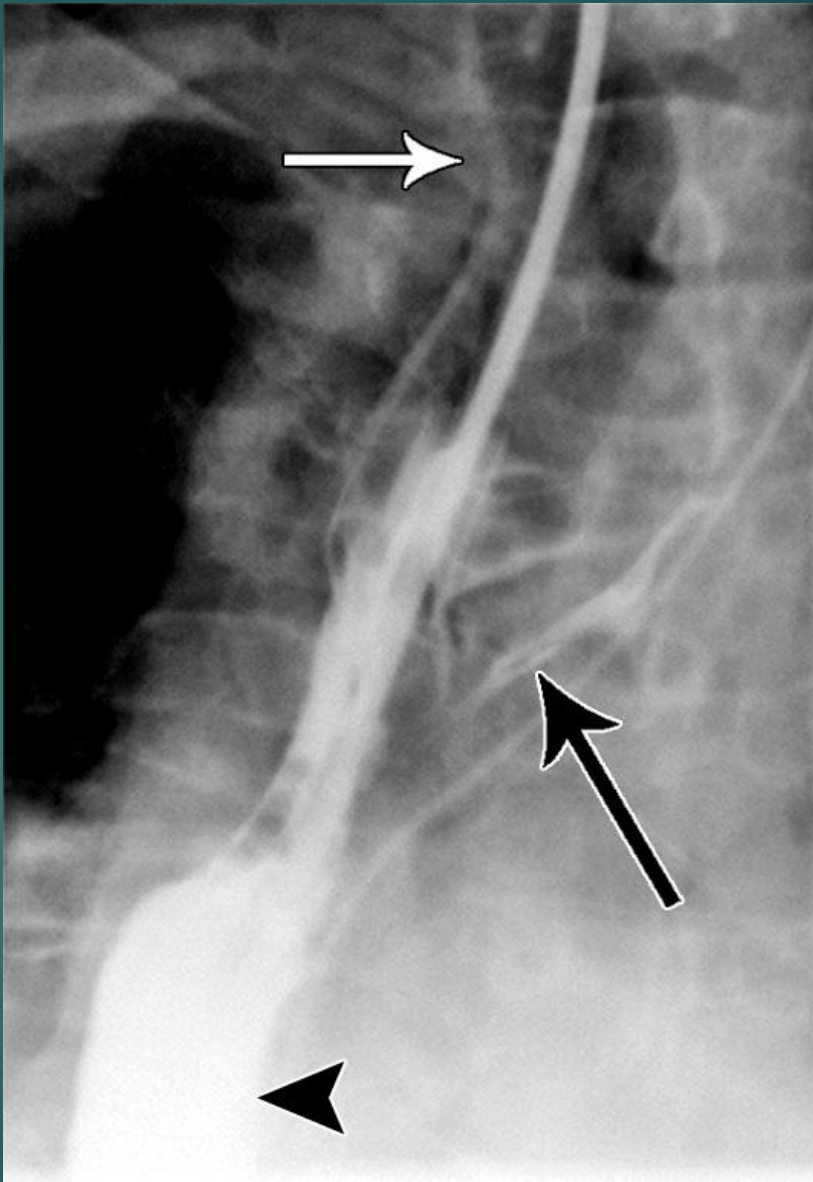
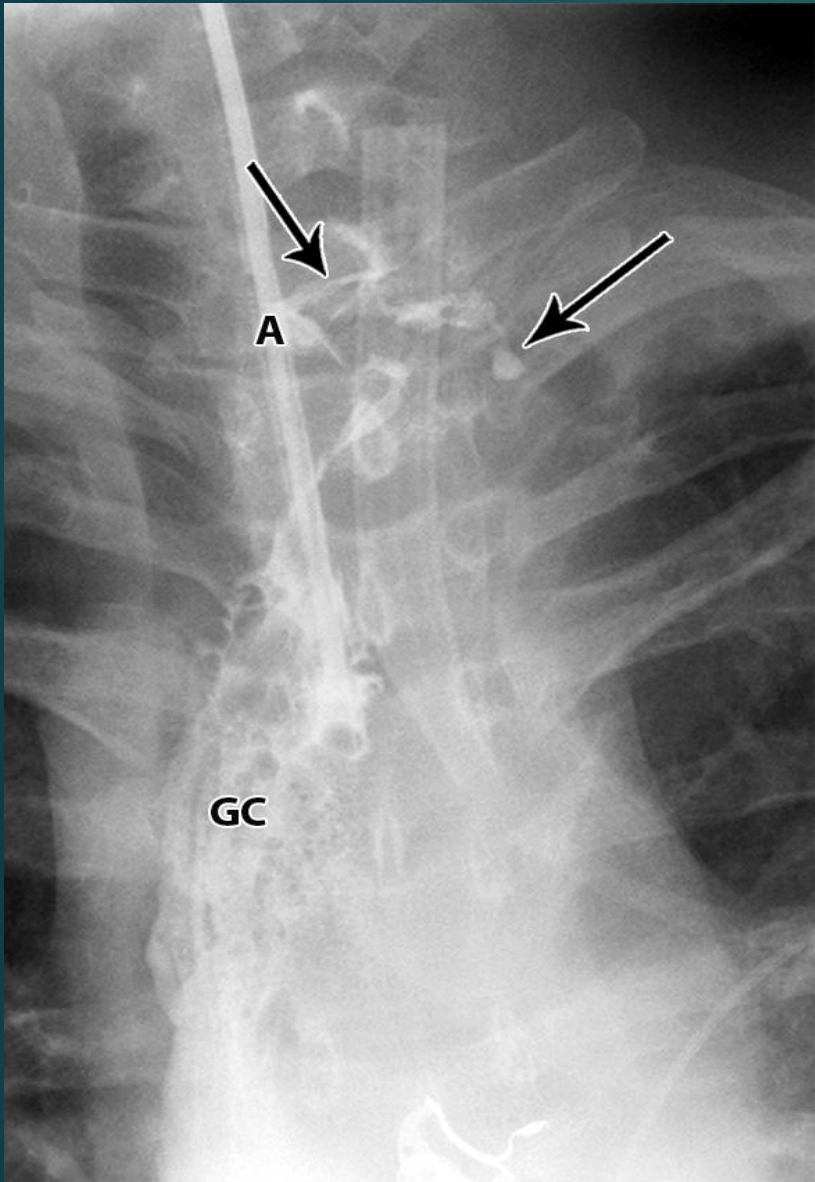


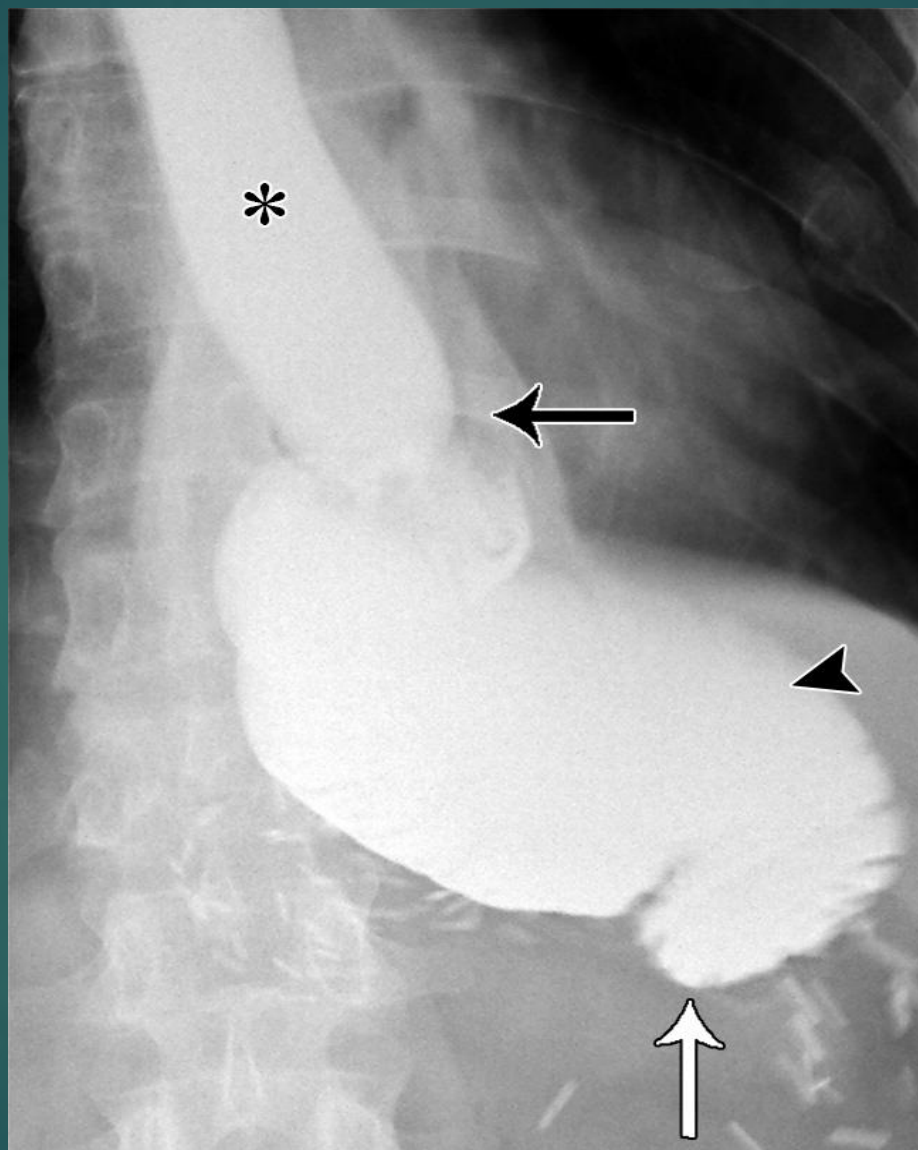
POST-OP COMPLICATIONS

- ▶ Routine post operative assessment after bariatric surgery, esophageal/gastric resection and re-anastomosis
- ▶ Look for anastomotic leaks/perforation
 - ▶ Leaks reported to occur in 10-44% of post-op patients
 - ▶ 40% of post-op mortality
- ▶ Also look for obstruction, delayed transit

POST-OP COMPLICATIONS

- ▶ Technique
 - ▶ Can do via indwelling NG or with active swallowing
 - ▶ Initially use water soluble iodinated contrast
 - ▶ Ideally follow with thin liquid barium (higher density – increased sensitivity in detecting small leaks)
 - ▶ Can do follow up CT if unclear about extraluminal contrast

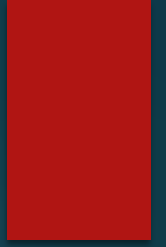




SMALL BOWEL FLUOROSCOPY

- ▶ Small bowel studies have become infrequent in the age of CT and MR imaging
- ▶ In hospital often just done to for small bowel transit assessment
 - ▶ In evaluation of obstruction requiring surgical intervention

CT Enterography (CTE) vs MR Enterography (MRE)



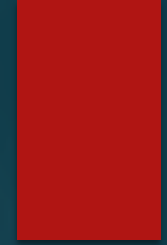
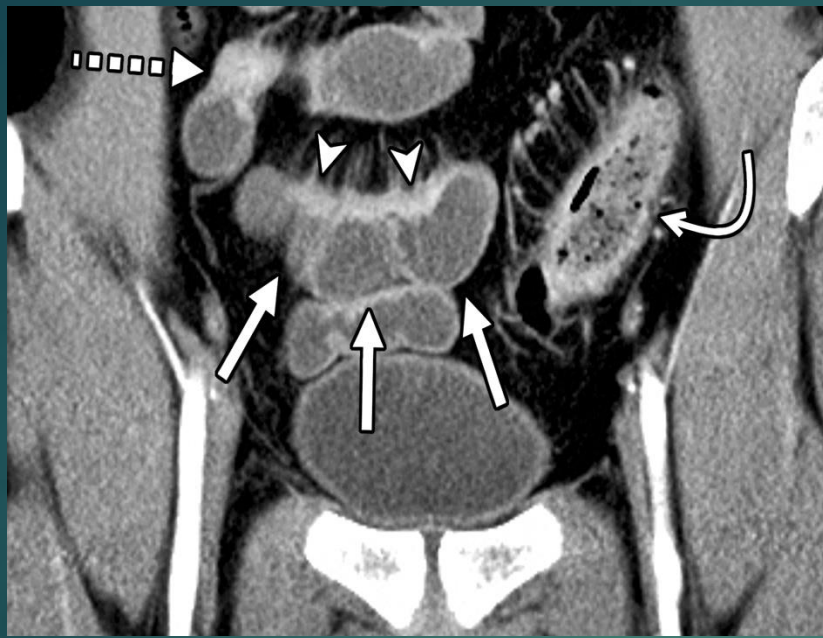
CT Enterography (CTE) vs MR Enterography (MRE)

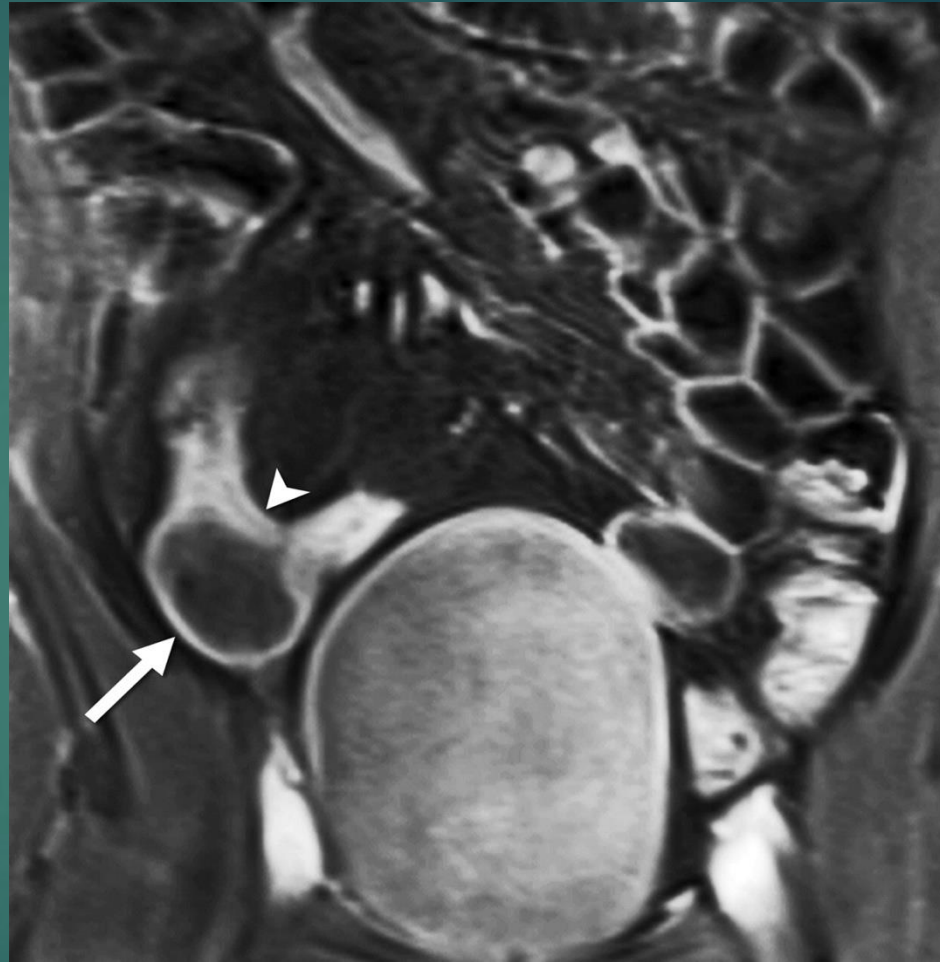
- ▶ Essentially have replaced barium studies (small bowel follow through and enteroclysis)
- ▶ Both can demonstrate bowel inflammation, penetrating disease, strictures in the setting of IBD
- ▶ Both can visualize extra-GI complications and assess mesenteric vasculature
- ▶ Both use comparable large volume of oral contrast (1.5 L of CoLyte)
- ▶ Both use IV contrast

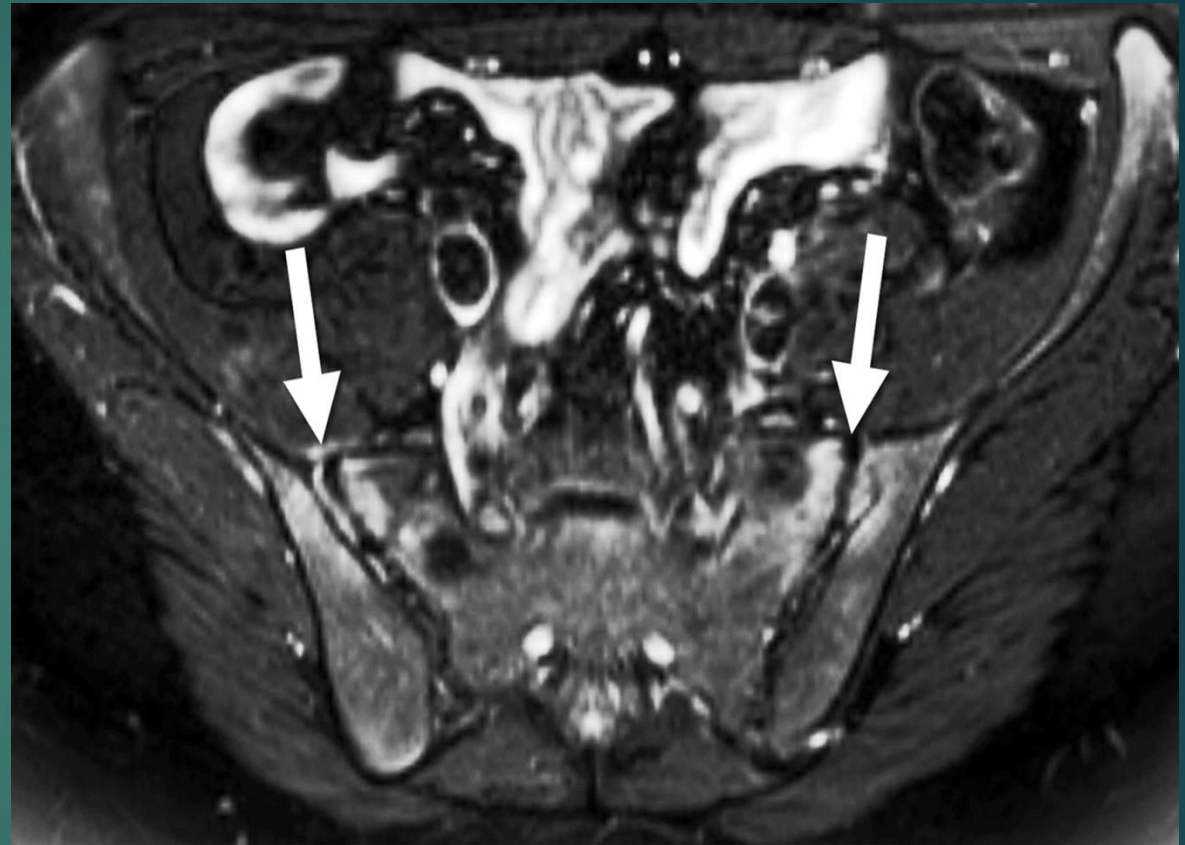
CTE	MRE
Can be done in minutes	Requires 20-30 minutes
No significant motion artifact	Requires antiperistalsis medication
Single breath hold acquisition	Multiple breath holds
Requires Radiation (although lower dose with new techniques)	No radiation
Good for acute imaging	Not suitable for acutely unwell patients
Better for claustrophobic patients	Magnet bore can cause claustrophobia
Available 24/7	Limited access
Better spatial resolution (for detecting small mural lesions)	Better tissue contrast (active inflammation vs. stricture without inflammation/fibro-stenotic disease); Can detect mucosal healing
Extraluminal air easier to see (pneumoperitoneum, vaginal, bladder, etc.)	Can do dynamic imaging (watch peristalsis)
Limited perianal assessment	Better for assessing perianal disease

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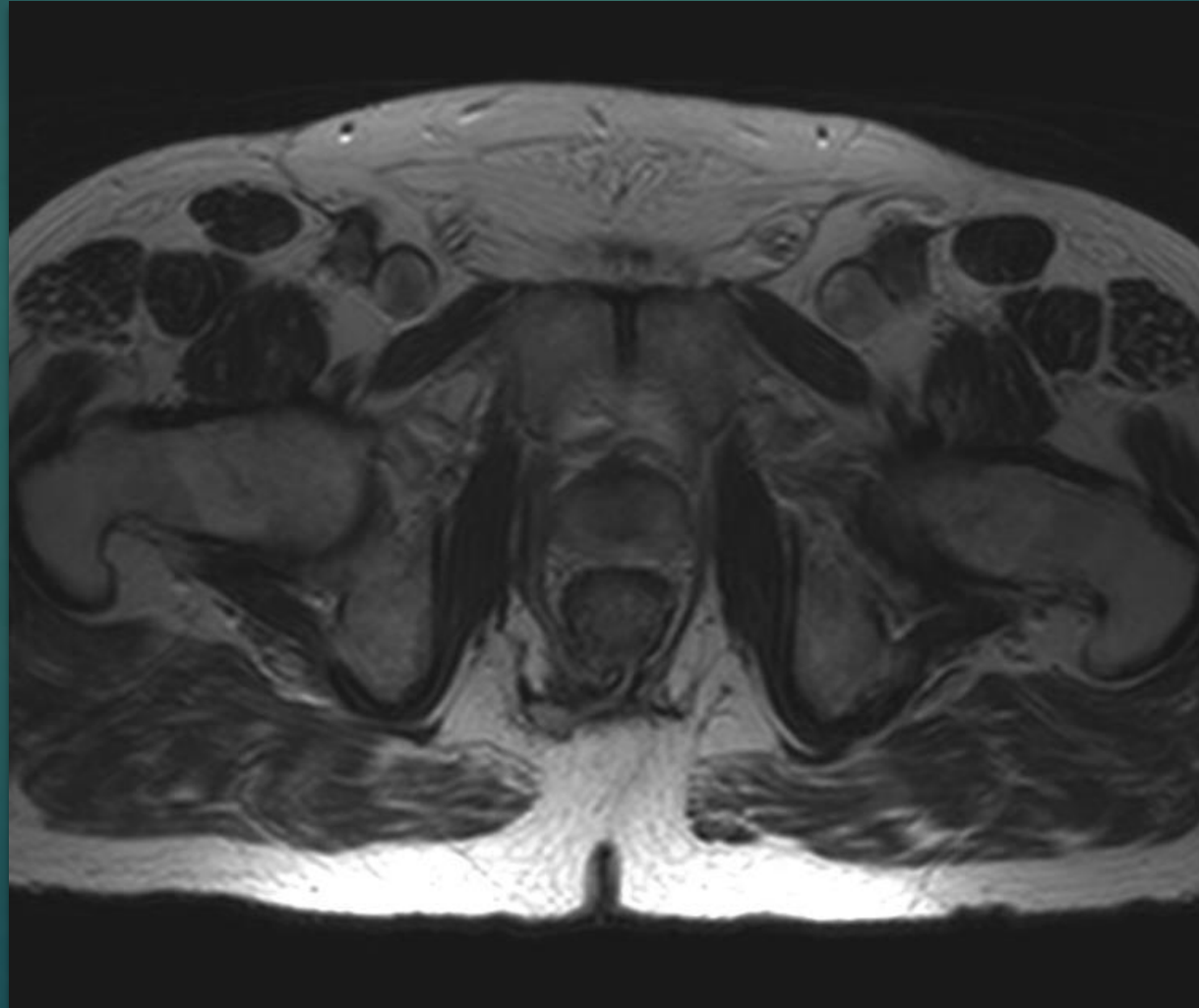




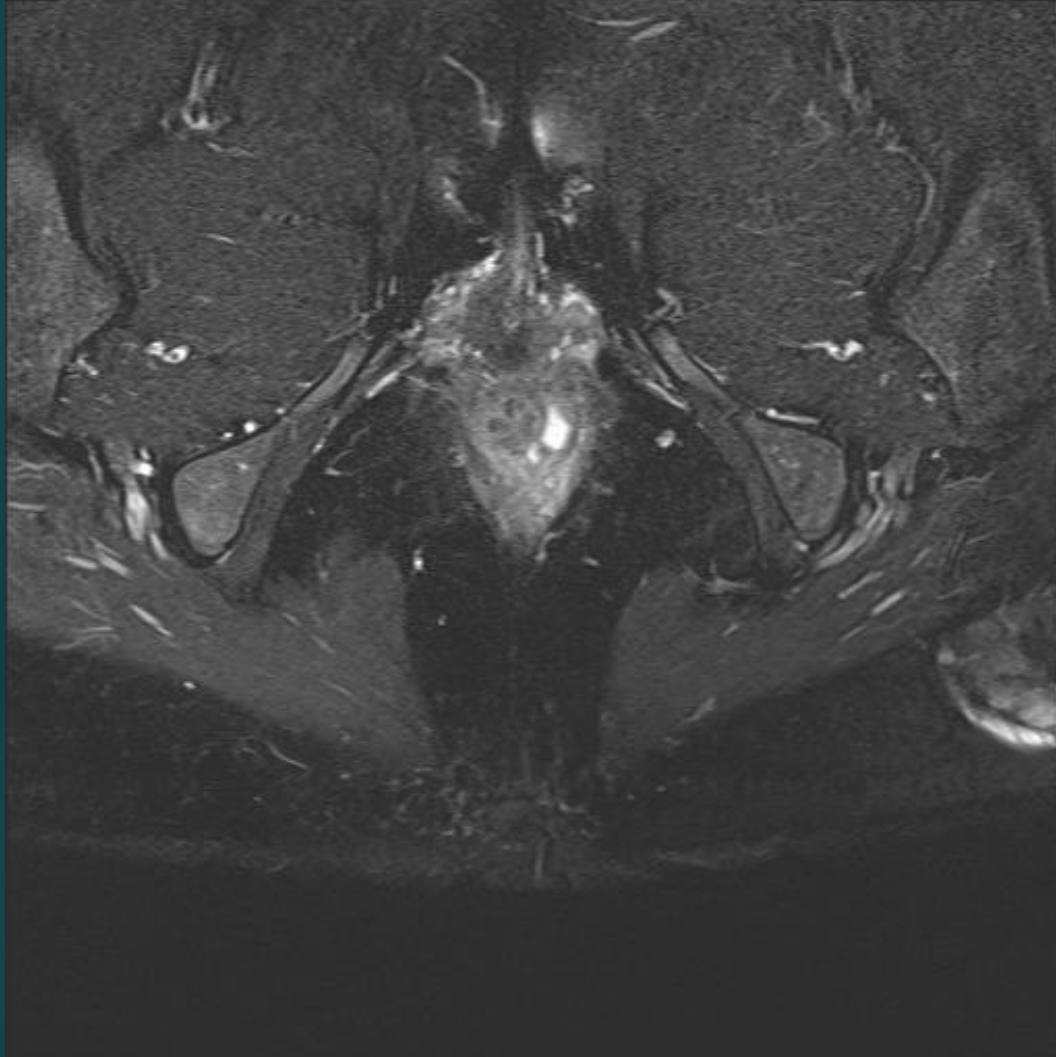
Why is perianal disease better assessed on MR?



Perianal fistula with small abscess visualized on MR

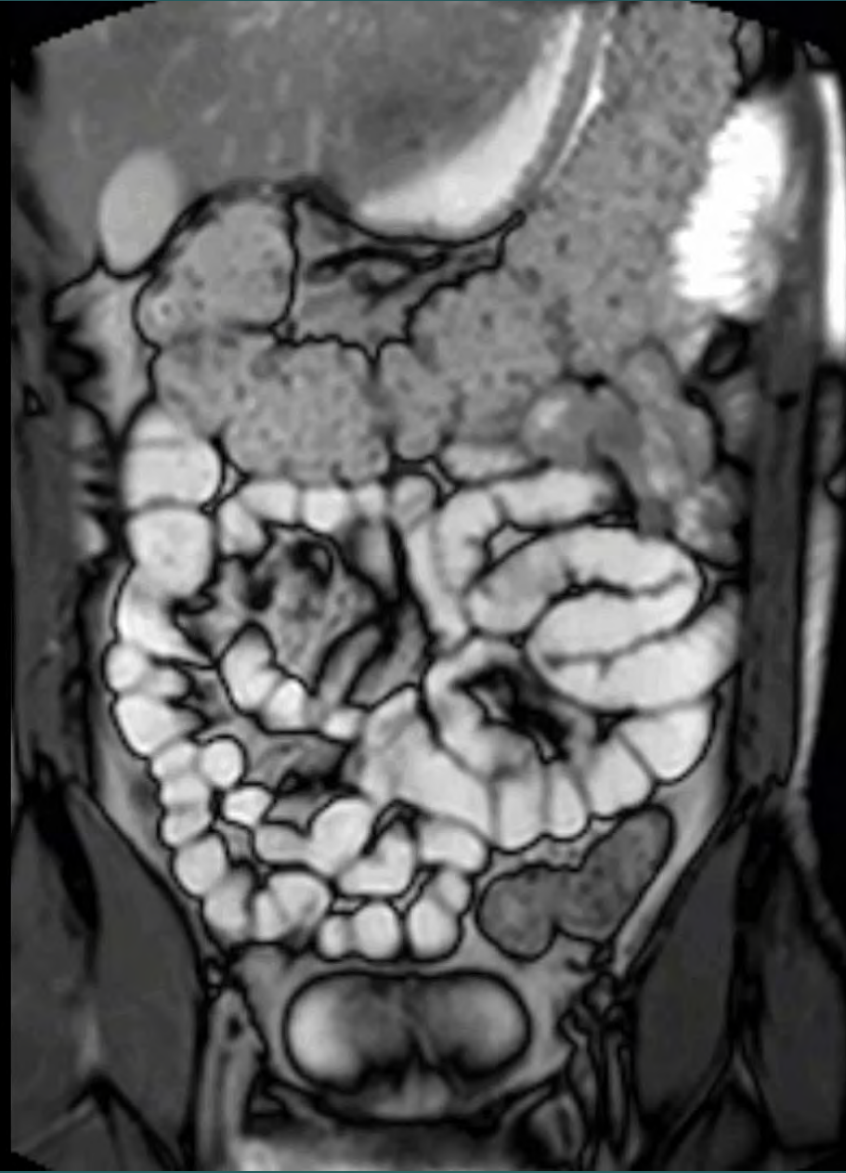


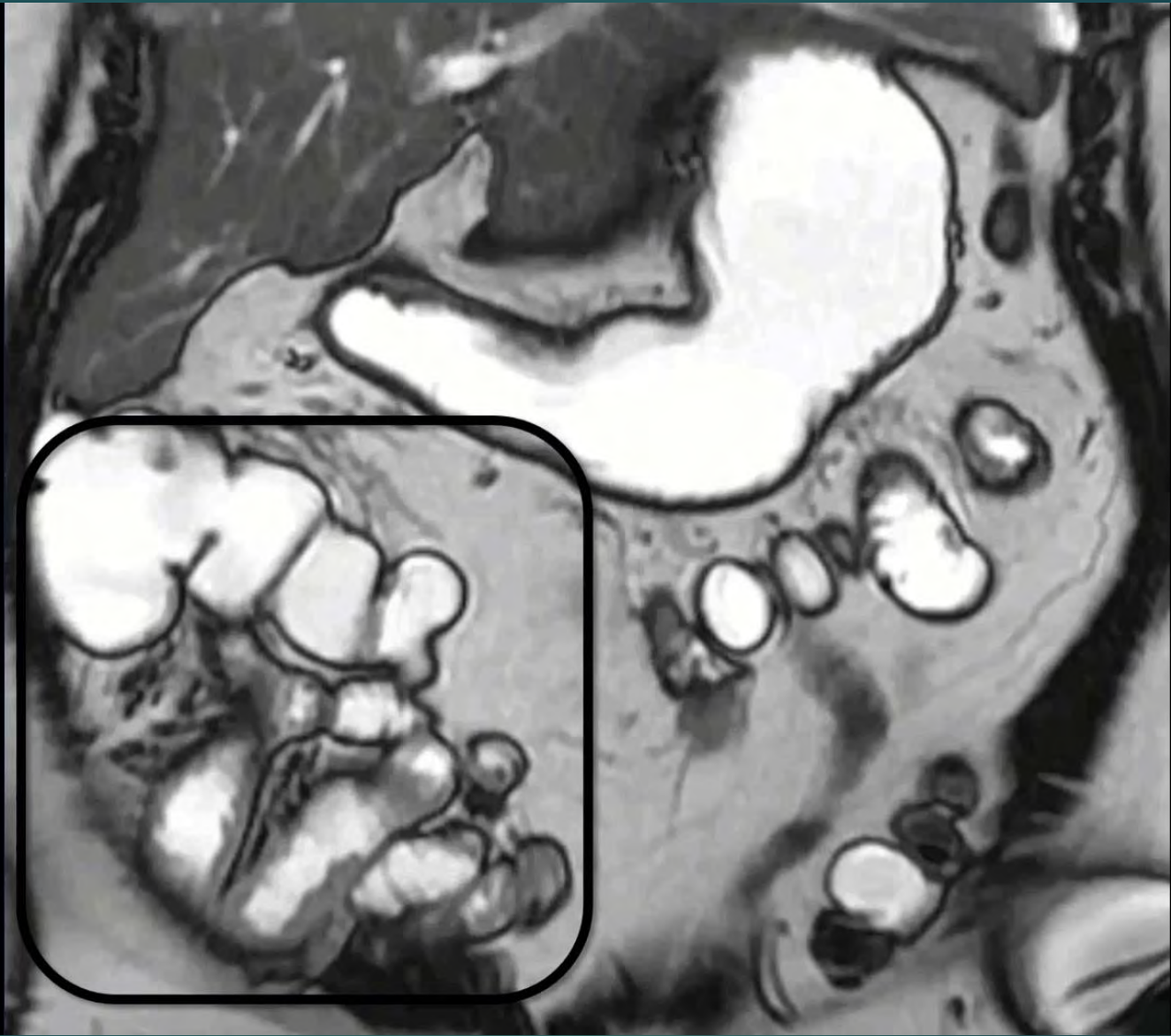
Simple perianal fistula



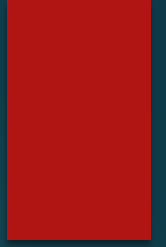
Functional assessment with MR







Imaging for GI Bleed (GIB)



Imaging for GI Bleed (GIB)

- ▶ Common GI cause of hospitalization
 - ▶ 80% – upper GI source (above Ligament of Treitz)
 - ▶ 15-30% - colon
 - ▶ 5-10% - small bowel

Imaging for GI Bleed (GIB)

- ▶ Multiple imaging modalities available to assess GIB, in addition to endoscopy:
 - ▶ CTA
 - ▶ CTE
 - ▶ NM RBC scan
 - ▶ Meckel scan (Tc-99m pertechnetate)
 - ▶ Catheter angiography

- ▶ ACG and SAR made consensus recommendations March 2024

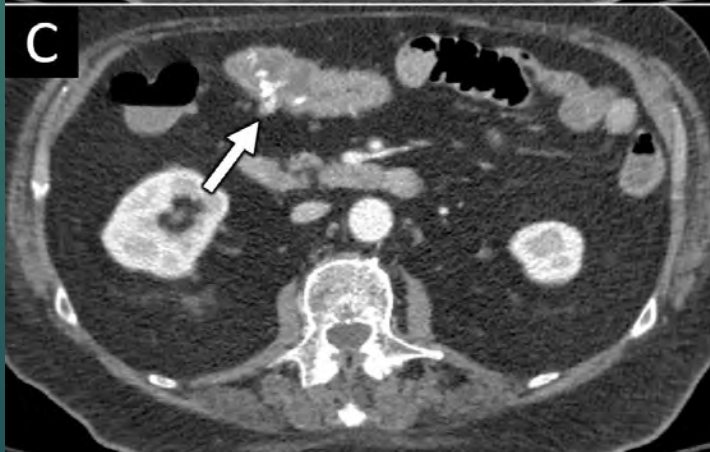
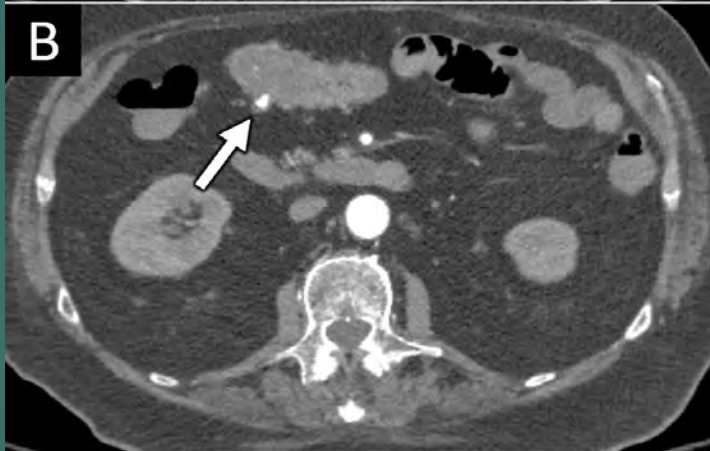
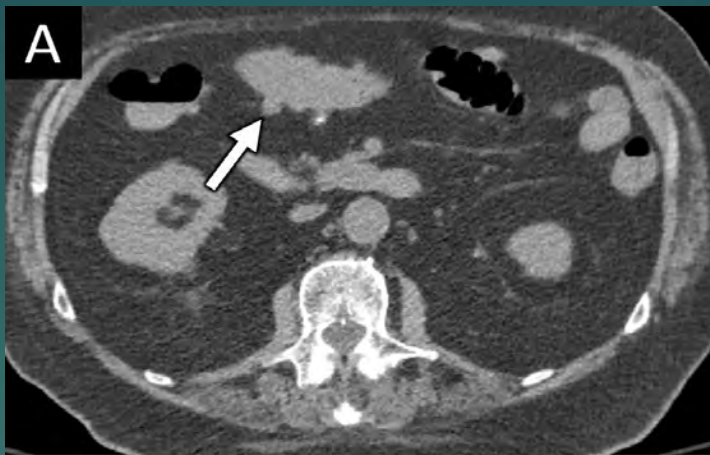
GIB - CTA

- ▶ Indication: Acute bleeding/hemodynamically unstable, typically done before catheter angiogram
- ▶ Technique: multiphase study without oral contrast (could obscure site of bleeding)
 - ▶ Unenhanced – to exclude high attenuating material in the lumen
 - ▶ Arterial/enteric phase, portal-venous, delayed
 - ▶ Look for contrast extravasation in lumen – accumulates, moves over time

GIB - CTA

- ▶ 85-90% sensitive, 92% specific and 94-95% accurate
- ▶ Can detect active bleeding at a rate as low as 0.1 mL/min
- ▶ Negative scan useful to exclude need for immediate intervention

- ▶ Limitation: requires iodinated I.V. contrast and radiation dose

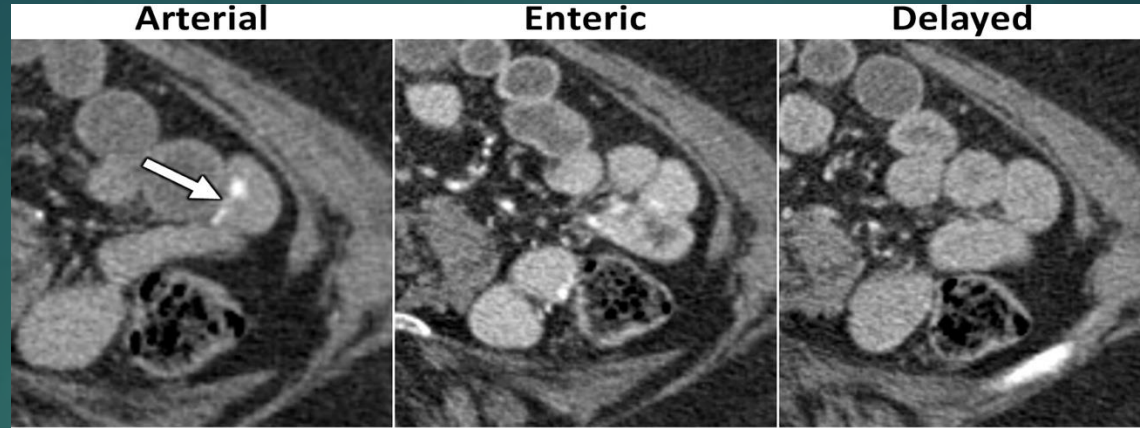


CTE

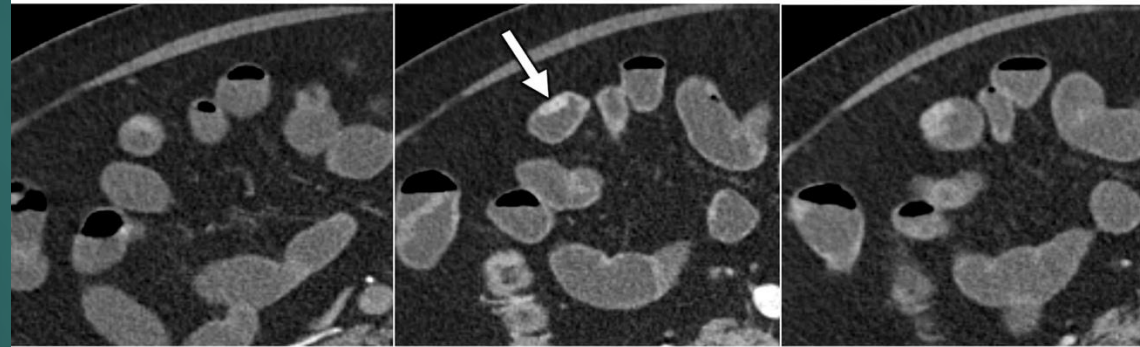
- ▶ Indications:
 - ▶ Hemodynamically stable patient
 - ▶ Negative upper endoscopy and colonoscopy (+/- negative capsule endoscopy)
 - ▶ Suggested if there is a risk of video capsule retention
 - ▶ First line imaging if concern is for small bowel neoplasm



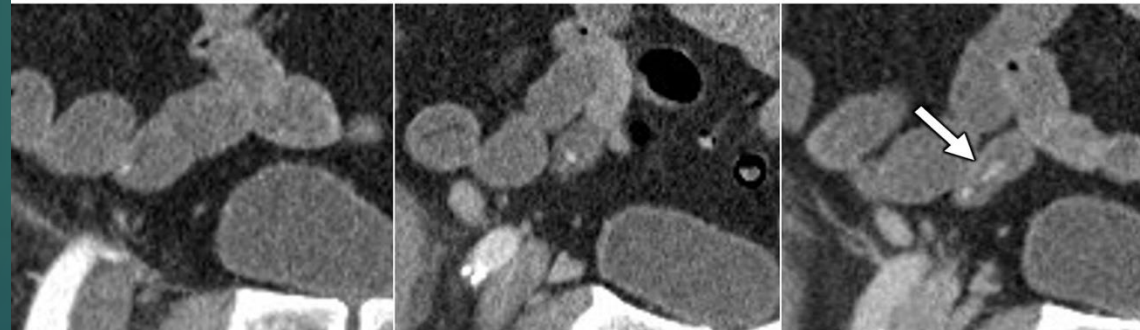
Developmental
vascular malformation



Neuroendocrine Tumour



Angiodysplasia





GIST

CTE

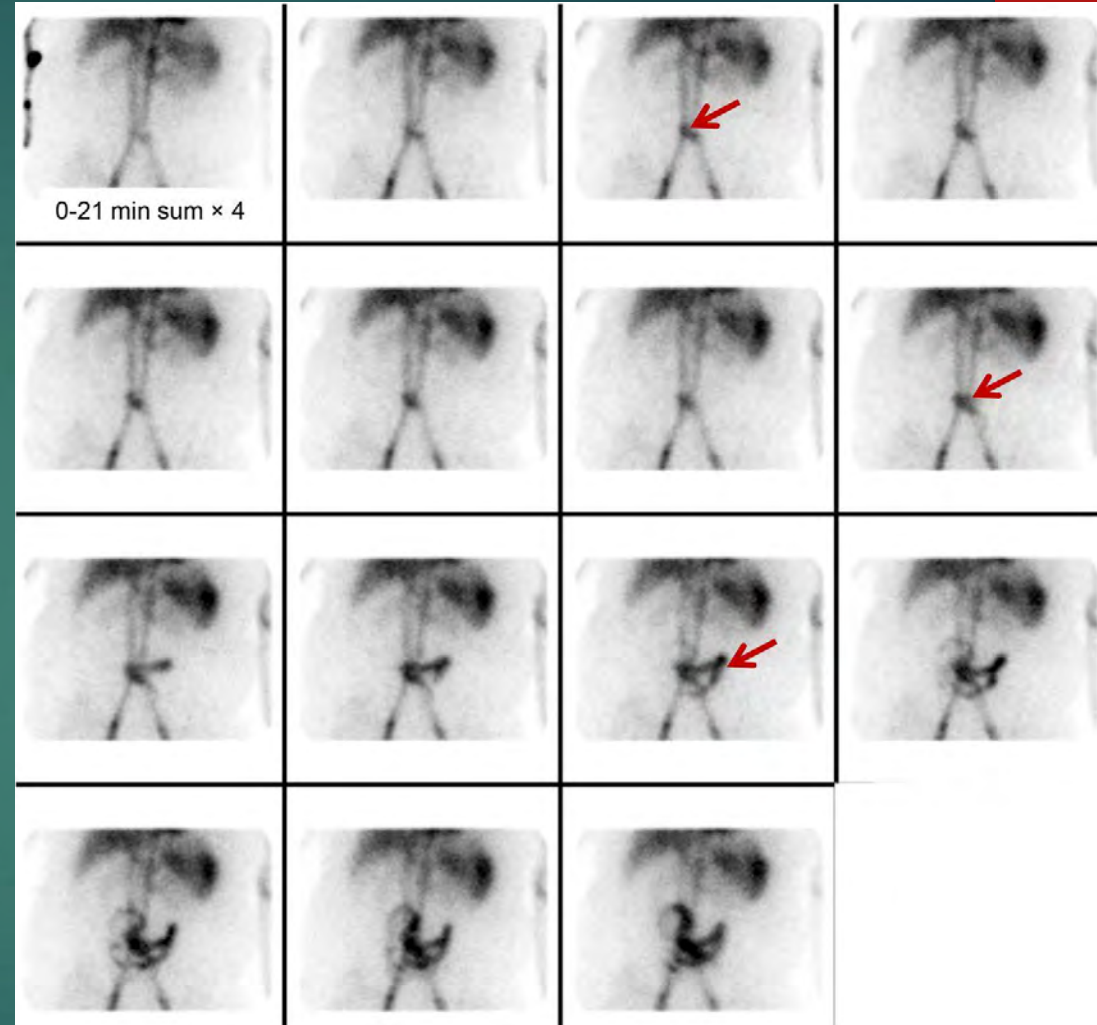
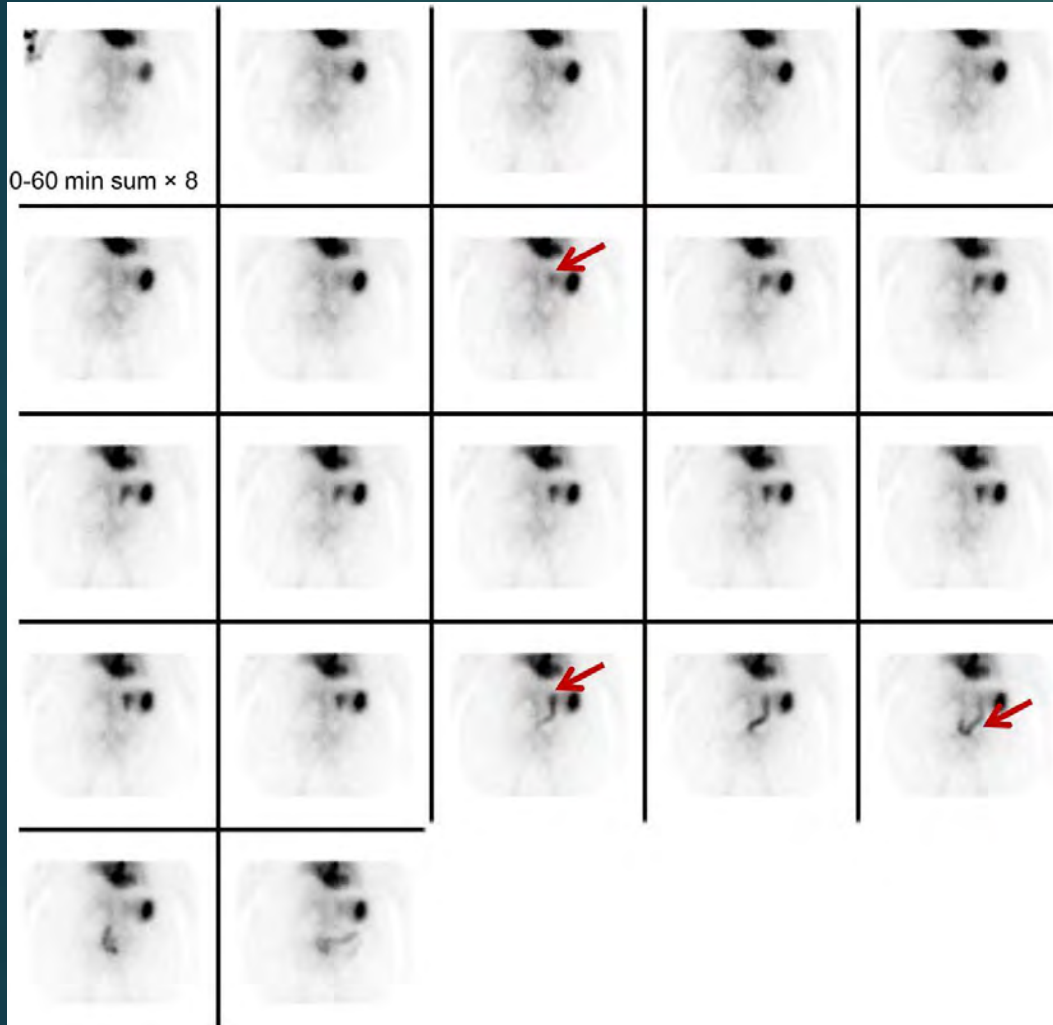
- ▶ Advantages:
 - ▶ Can detect small, mural based masses
 - ▶ Can assess serosa/adjacent mesentery
- ▶ Limitations:
 - ▶ Need I.V. iodinated contrast
 - ▶ Radiation
 - ▶ Poor distention limits mucosal assessment
 - ▶ Sensitivity and specificity variable in the literature - slightly better if there is overt bleeding

NM Imaging

- ▶ Indications:
 - ▶ Hemodynamically stable
 - ▶ Ongoing bleeding
 - ▶ Negative endoscopy
 - ▶ Negative CTA (or unable to do CTA)

NM Imaging

- ▶ Technique
 - ▶ Tc-99m RBC Scan
 - ▶ Radiotracer injected with images obtained every minute for 1 hour
 - ▶ Look for:
 - ▶ Focus of extracellular activity
 - ▶ Activity increases over time
 - ▶ Moves antegrade/retrograde
 - ▶ Conforms to bowel
- ▶ Meckel Scan (Tc-99m pertechnetate) specifically for Meckel diverticulum – targets ectopic gastric mucosa in a Meckel diverticulum



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Erin Grady J Nucl Med 2016;57:252-259

NM Imaging

- ▶ Sensitivity 93%, Specificity 95%
 - ▶ Higher accuracy if used with SPECT/CT
- ▶ If positive by 9 minutes, high correlation with positive findings at catheter angiogram

NM Imaging

- ▶ Advantages:

- ▶ Higher sensitivity for low rate of bleed (as low as 0.04mL/min) and intermittent bleeding
- ▶ Can also do delayed imaging, up to 24 hours
- ▶ Lower dose than CTA

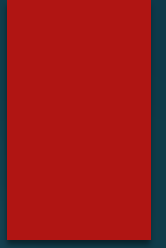
- ▶ Limitations:

- ▶ Patient must be stable enough for the longer imaging time
- ▶ Not ideal in patients with low HCT, recent transfusion, sickle cell disease, thalassemia or recent heparin use

Catheter Angiography

- ▶ Indications:
 - ▶ Unstable patients with intent to embolize
 - ▶ Active bleeding on CTA (rarely done without preceding CTA)
 - ▶ Not done if CTA negative
 - ▶ Unsuccessful endoscopic treatment of GIB
- ▶ Technically successful embolization is 95%, but up to 25% re-bleed
- ▶ Limitations:
 - ▶ Invasive
 - ▶ Can result in bowel ischemia (typically managed conservatively) - up to 10%
 - ▶ Challenging in patients with severe atherosclerosis, variant anatomy, intermittent bleeding
 - ▶ Requires I.V. iodinated contrast and radiation

CT COLONOGRAPHY



CT COLONOGRAPHY (CTC)

- ▶ Colorectal cancer (CRC) third most common malignancy in Canada
- ▶ Despite organized screening programs, almost 50% of CRC is diagnosed at Stage III or IV
 - ▶ No screening program meets the minimum 60% uptake
 - ▶ Worse uptake during Covid-19 pandemic
- ▶ CTC validated option for colon screening

Indications for CTC

SCREENING	DIAGNOSTIC
Asymptomatic average risk	Incomplete colonoscopy
Asymptomatic with + FH	Problem solving
Asymptomatic and high risk for scope	Unexplained GI symptoms, anemia, bleeding
Patient preference/declines scope	Surveillance of 6-9mm lesion
	Evaluation of colon proximal to an obstructing lesion
	Surveillance following prior resection of cancer/polyp
	Staging of known neoplasm and exclusion of metachronous lesions

* Colonoscopy still first line for patients at high risk of CRC

CTC

- ▶ 2010 Canadian study showed CTC may be done in 70% of patients and can off-load colonoscopy wait times
 - ▶ 37% of patients state they would not have gone for screening otherwise
 - ▶ May detect slightly less polyps than colonoscopy, but scan more patients

CTC For Incomplete Colonoscopy

- ▶ In the setting of obstructing lesions
 - ▶ Prevalence of synchronous CRC is 5-7%
 - ▶ > 1/3 of synchronous lesions occur in one or more segments away from the incident lesion
 - ▶ Management altered in 20% of patients with occlusive disease and incomplete scope

CTC Contraindications

Clinical Scenario	Comments
Fulminant colitis	Any acute inflammatory condition increases propensity for perforation
Symptomatic acute colitis	
Acute diverticulitis	4-6 weeks after acute episode. Risk of perforation is low quoted at 1-5/1000 ²⁴
Recent colorectal surgery	Recommendations suggest wait time of 4-6 weeks post-surgery
Colon containing inguinal hernia	This is a relative contraindication; ensure the hernia is reducible prior to the study
Recent deep endoscopic biopsy or polypectomy	Variable guidance with regards to timing. Safe recommended interval varies between 2-4 weeks. IF there has been endoscopic mucosal resection (EMR) for instance (with flat lesions) and lesion is proximal suggestion is to stay closer to the 4-week interval. Left sided polypectomy on the other hand 2 weeks may be sufficient ⁶
Symptomatic or high-grade bowel obstruction	
Hereditary polyposis or non-polyposis syndromes	
Inflammatory bowel disease	This is a relative contraindication as CTC does not have utility for screening in this patient population due to the risk of dysplasia and cancer in the setting of longstanding IBD, however it may be used for problem solving (for instance in stricturing disease as long as the limitations are discussed with the referring GI.

Adapted from ACR-SAR-SCBT practice parameter for the performance of CTC in adults.ⁱ

CTC Safety

- ▶ Low risk of perforation
 - ▶ < 0.05%

CTC Safety

- ▶ Risk factors for perforation
 - ▶ Manual insufflation with room air
 - ▶ Inexperienced operator
 - ▶ Recent scope with polypectomy
 - ▶ Suggest waiting 2-4 weeks depending on polypectomy site
 - ▶ Scan first with unenhanced CT to exclude occult perforation
 - ▶ Older patient
 - ▶ Large bowel containing hernias
 - ▶ Diverticulosis
 - ▶ Obstructing neoplasm

CTC Safety

- ▶ Radiation exposure is small and risk of radiation-induced cancer with multiple screening studies is far outweighed by benefit of screening (benefit:risk = 24:1)
 - ▶ Doses have been progressively decreasing with advances in technology
- ▶ **Do not require contrast administration (unless doing simultaneous staging)**

Extracolonic Findings (ECF)

- ▶ Categorized as clinically unimportant to potentially important
 - ▶ 70% of studies have ECF, 85% of these are normal variants or benign with no further work up required
 - ▶ Potentially significant findings seen in older or symptomatic patients
 - ▶ 4% of the important ECF represent malignancy
 - ▶ Lung, kidney, lymphoma
 - ▶ Other important findings that may require further management in 8% of patients:
 - ▶ AAA, chronic liver disease, renal calculi
 - ▶ Opportunistic screening (osteoporosis, fat quantification)
- ▶ **Newer, low dose techniques reduce sensitivity in detecting ECF**

CTC Preparation

- ▶ Need appropriate bowel prep otherwise sensitivity of test affected
- ▶ Prep
 - ▶ Cathartic agent
 - ▶ Tagging kit
 - ▶ 2% w/v barium solution with iodinated contrast agent
 - ▶ Helps distinguish polyps or cancers from other soft tissues
 - ▶ Coats lesion
 - ▶ Tagging helps outline residual fluid/fecal content
 - ▶ Can "subtract" the high attenuating tagging material from image
 - ▶ We use a two-day prep, but some centres do one day prep

CTC Preparation

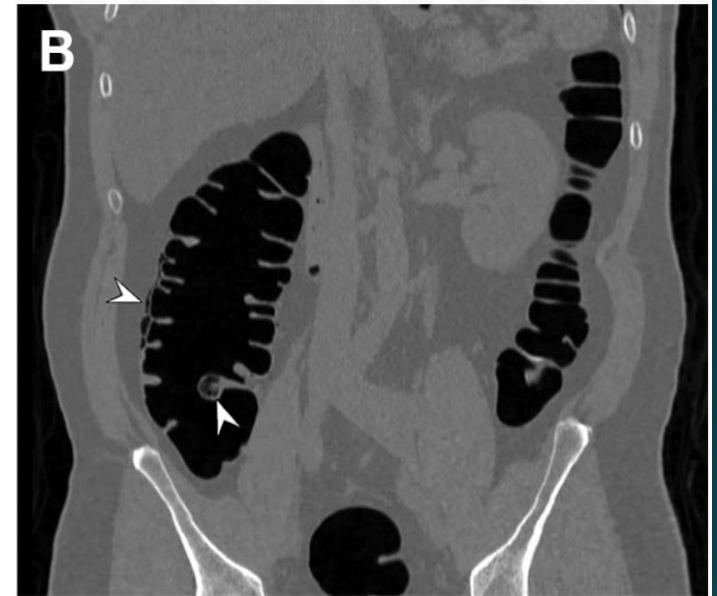
- ▶ Not ideal, but can do without cathartic, just tagging with water-soluble iodinated material
 - ▶ For large lesion detection
- ▶ Can do same day post incomplete scope
 - ▶ Give at least 30 mL of ionic water-soluble contrast
 - ▶ Wait 2-3 hours to “tag” fluid (longer the wait time the better the tagging)

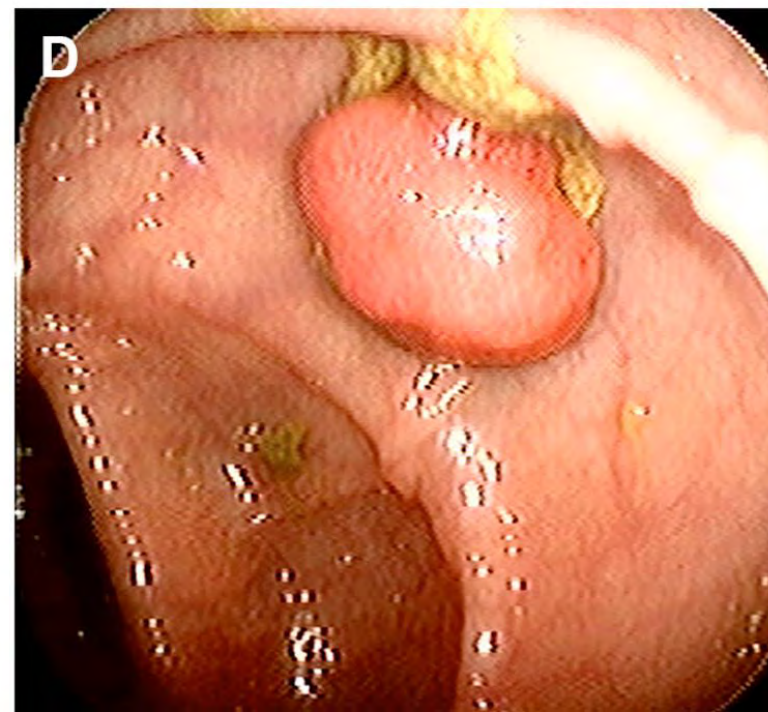
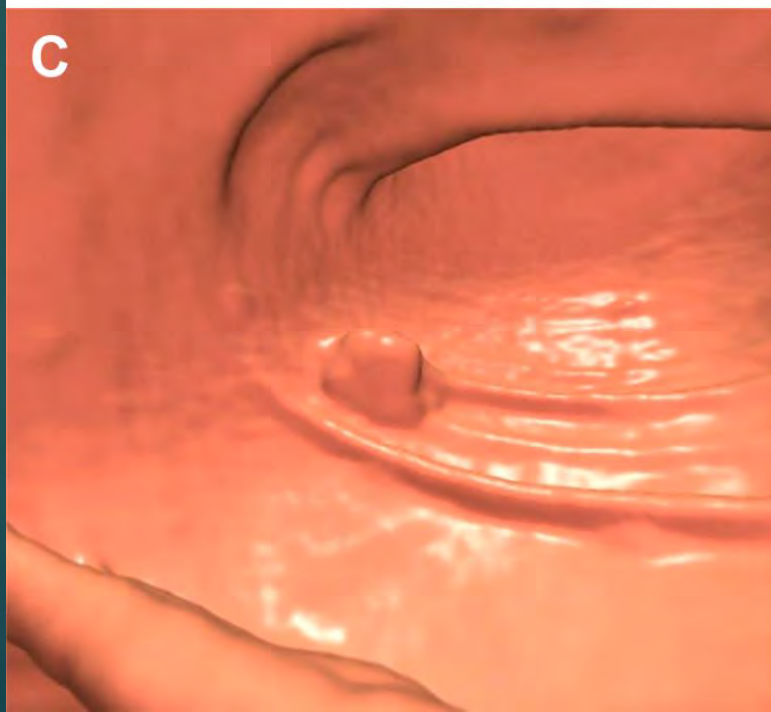
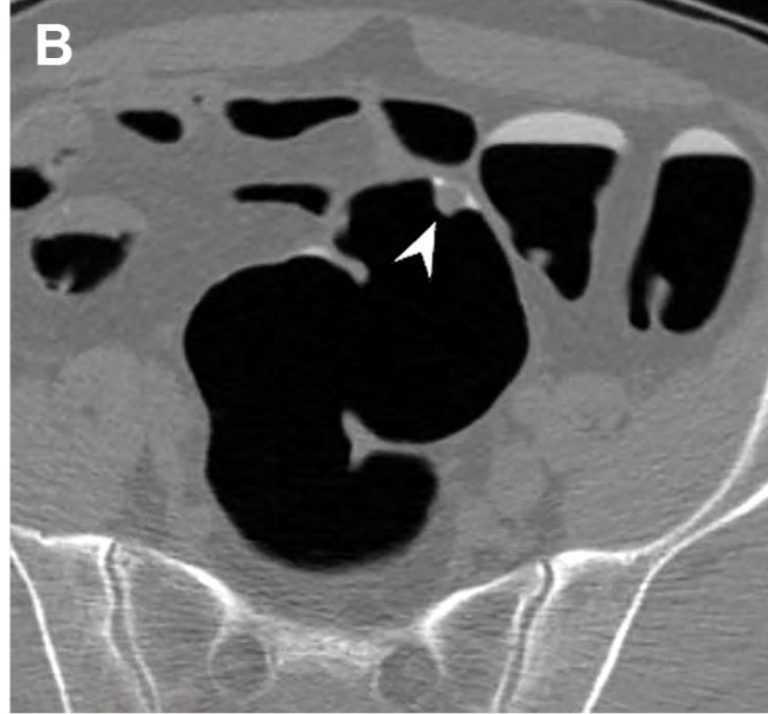
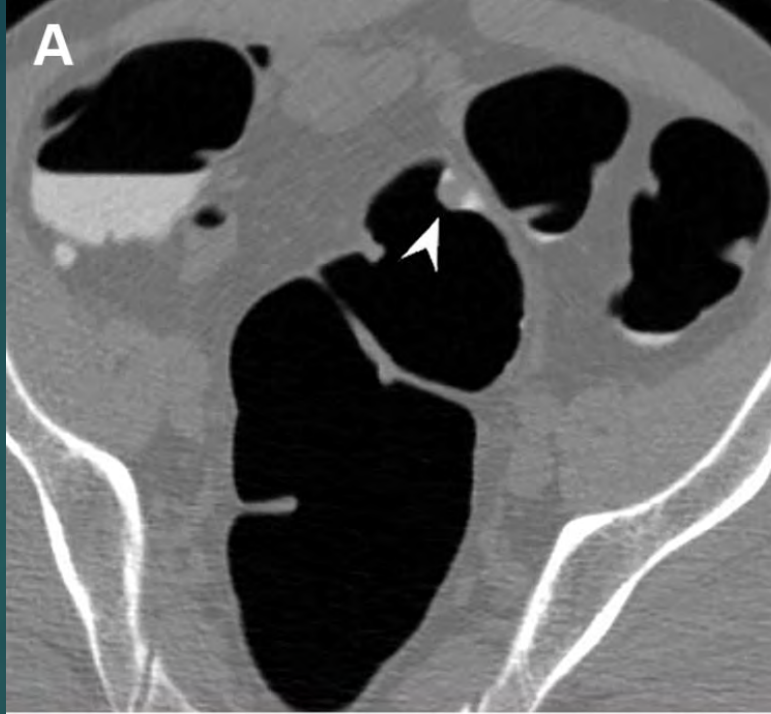
CTC Technique

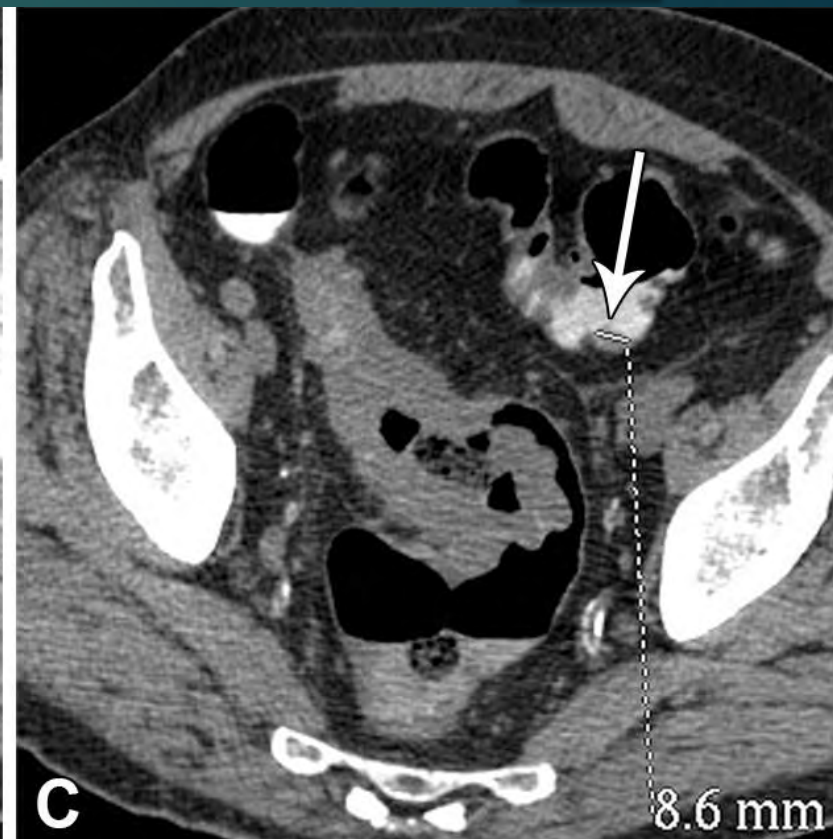
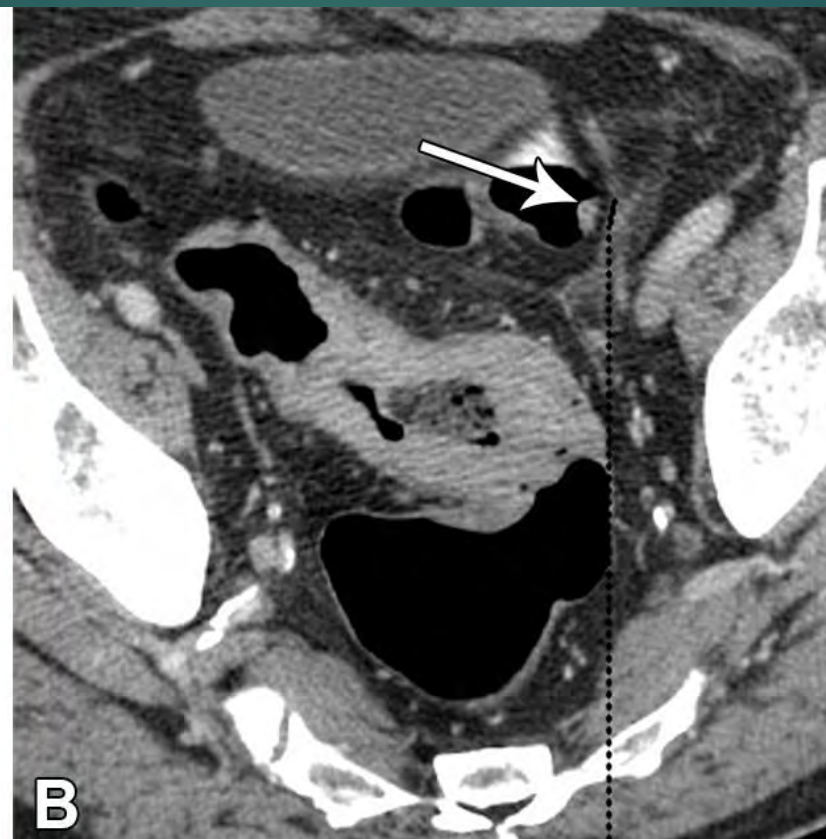
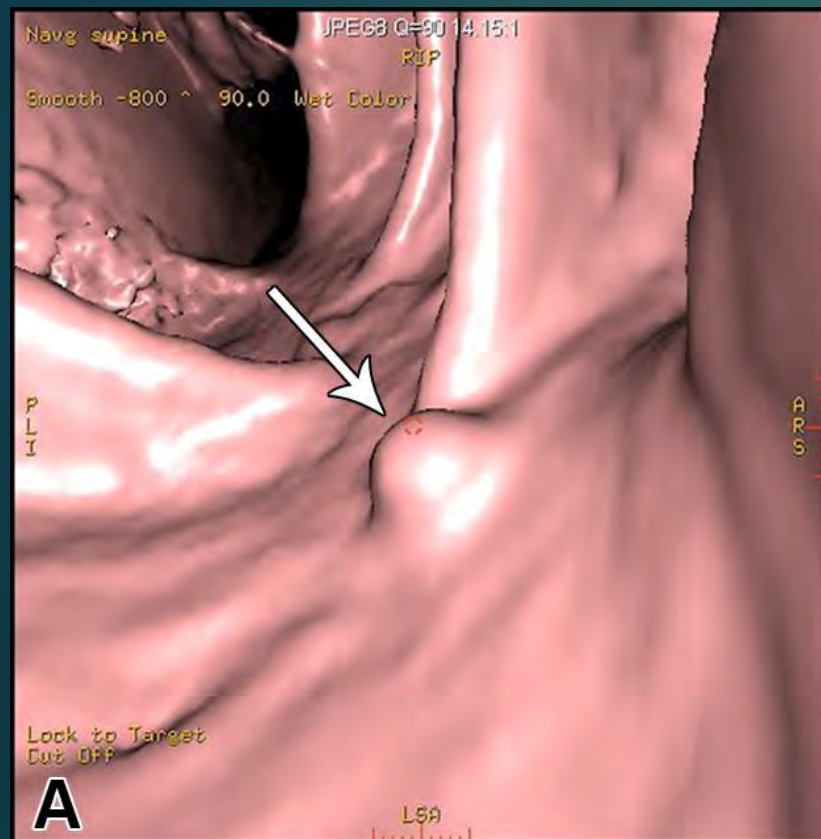
- ▶ Bowel evacuated immediately prior to imaging
- ▶ Rectal tube inserted by trained staff (Radiologist/Resident)
- ▶ Mechanical insufflation with CO₂
 - ▶ target pressure of 20-25 mmHg
- ▶ Check distention on scout image
 - ▶ Incompetent ICV may be an issue
 - ▶ Can do in patients with colostomy
- ▶ Hyoscine butylbromide to facilitate bowel distention

CTC Technique

- ▶ Patient imaged in at least two positions
 - ▶ Supine, prone, decubitus





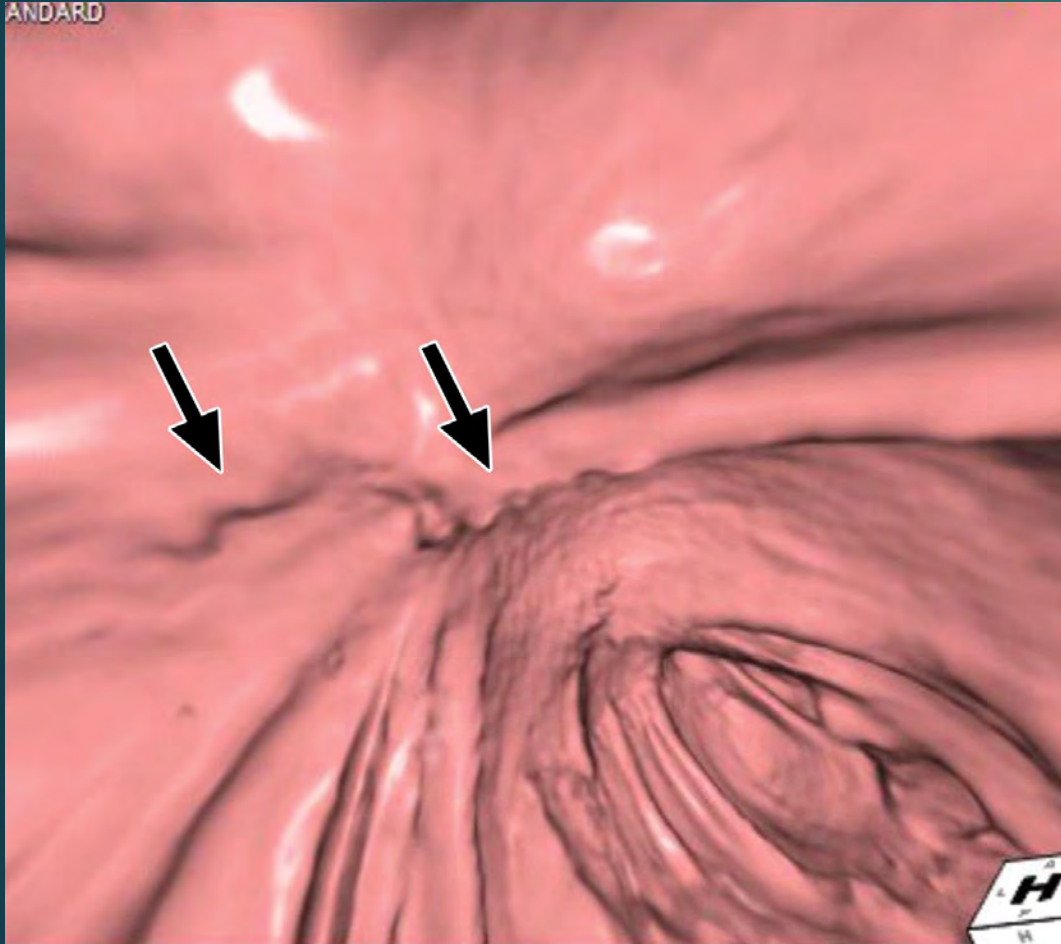


CTC after incomplete colonoscopy – obstructing sigmoid lesion with upstream polyp

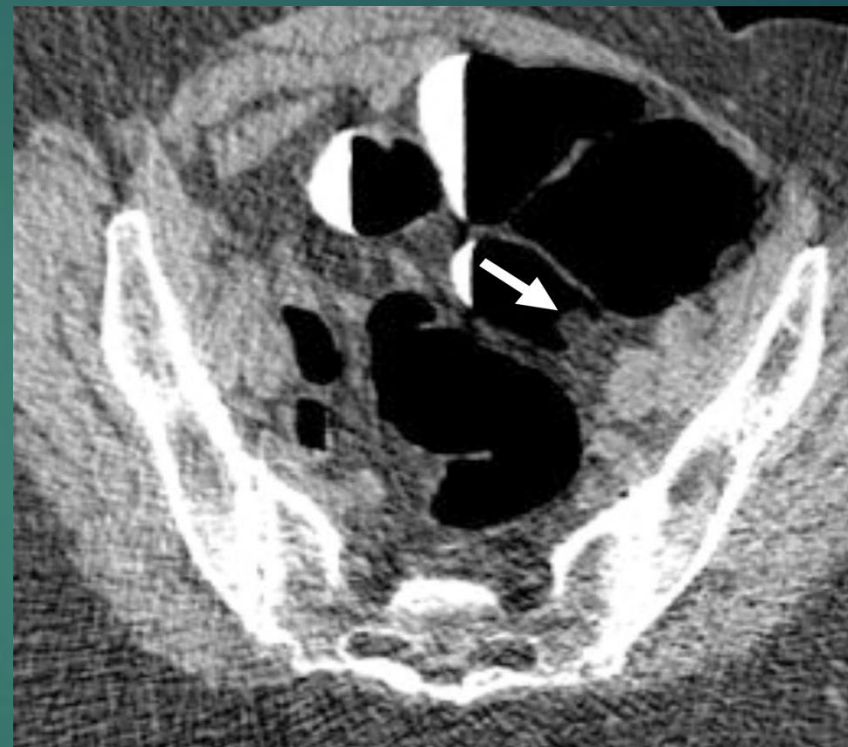
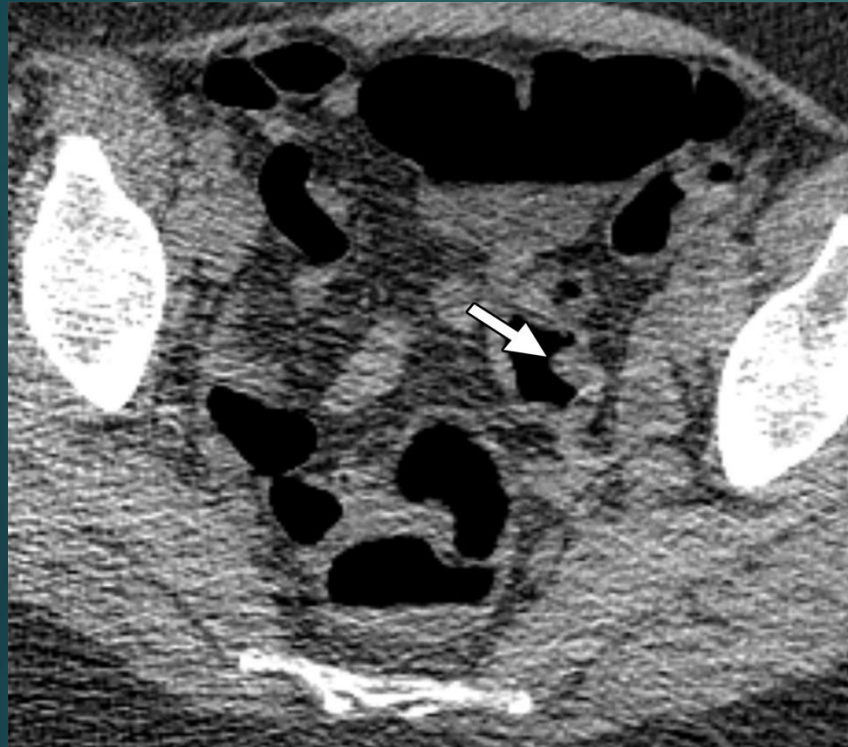
LIMITATIONS

- ▶ Known limitation in small polyp detection (< 6mm)
- ▶ Challenging to assess sessile, flat lesions

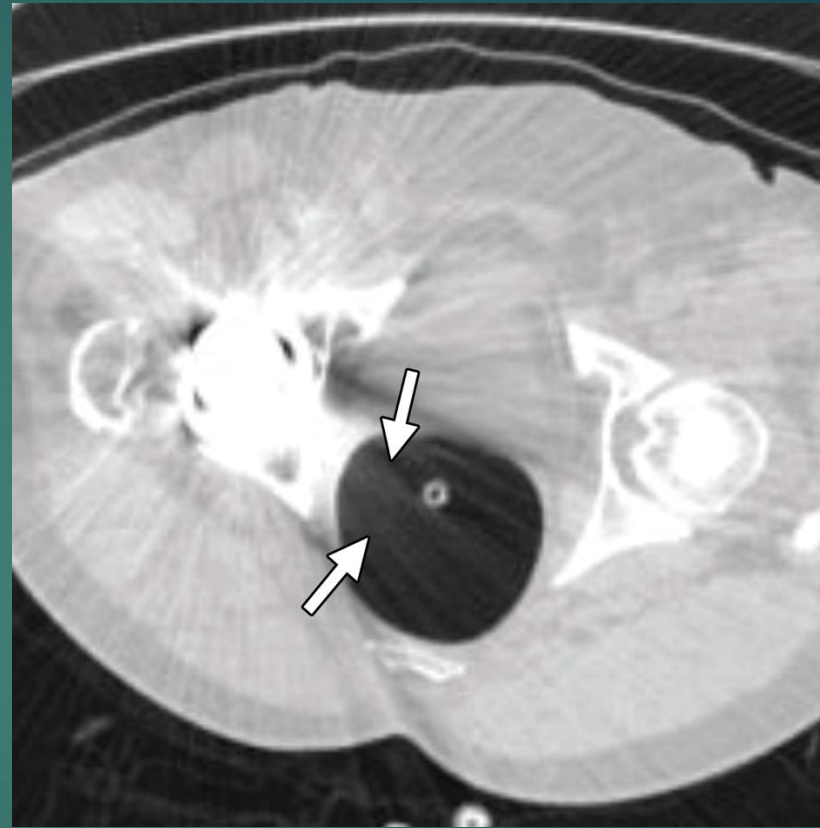
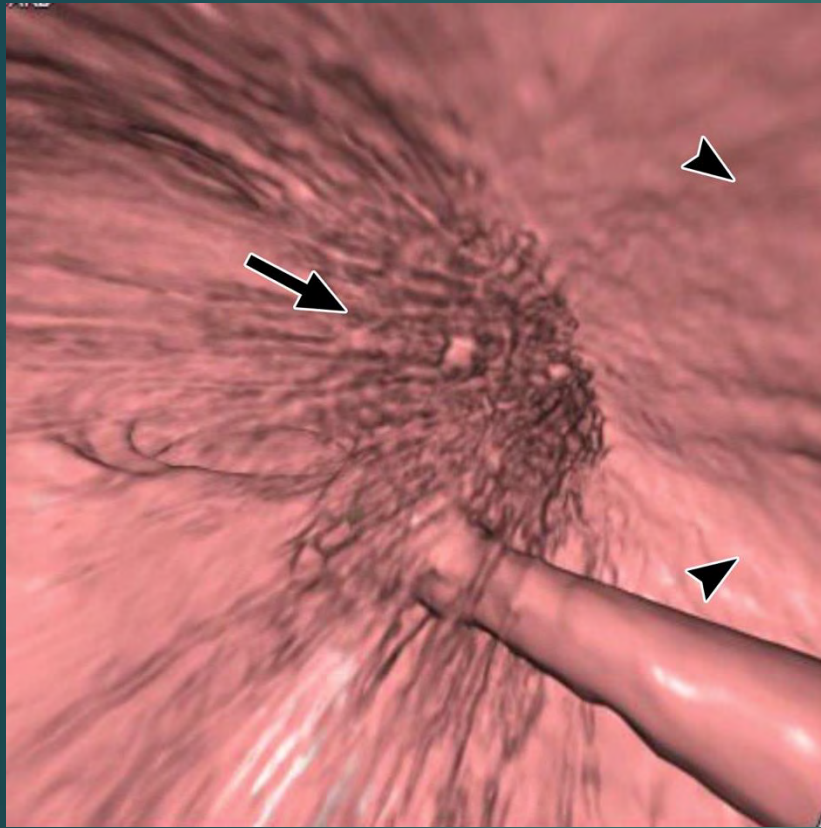
PATIENT MOTION

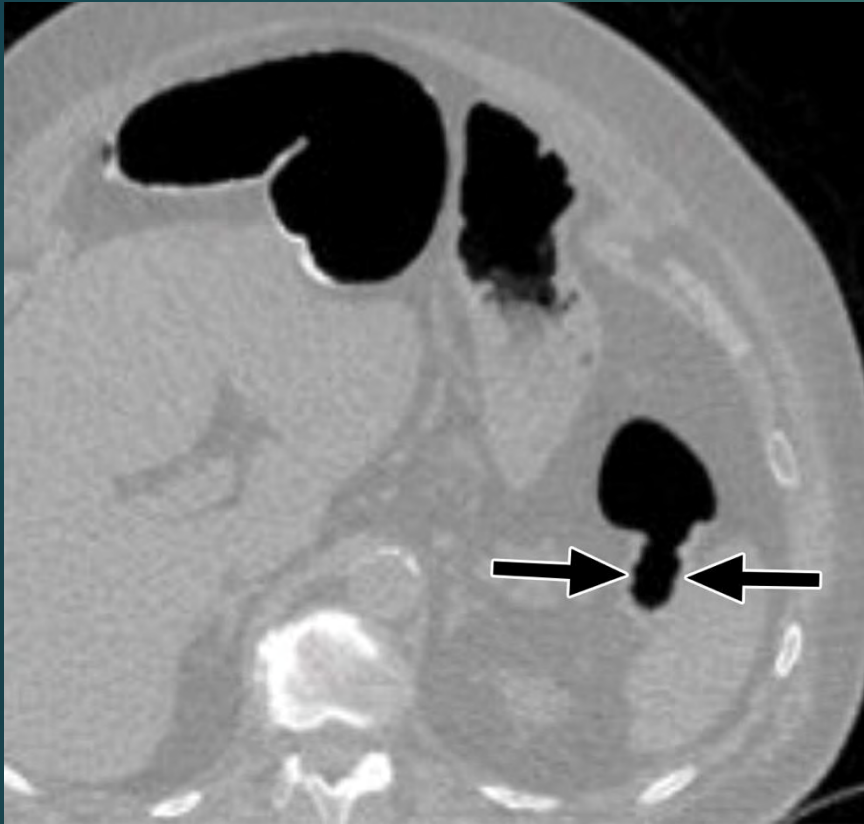


NOISE ARTIFACT FROM BODY HABITUS



INCREASE DOSE





SPASM



CHANGE IN POSITION

C-RADS Categories

C0 - Inadequate Study

- inadequate prep: cannot exclude lesions $\geq 10\text{mm}$ owing to presence of fluid/feces
- inadequate insufflation: one or more colonic segments collapsed on both views
- awaiting prior colon studies for comparison

Refer back for repeat examination

C1 - Normal or Benign Lesion

- no visible abnormalities of the colon
- no polyp $\geq 6\text{mm}$
- lipoma or inverted diverticulum
- nonneoplastic findings

Continue routine screening

C2 - Intermediate Polyp or Indeterminate Finding

- intermediate polyp 6-9 mm, < 3 in number
- indeterminate findings, cannot exclude polyp $\geq 6\text{mm}$ in technically adequate exam

Surveillance or colonoscopy

C3 - Polyp, possibly advanced adenoma

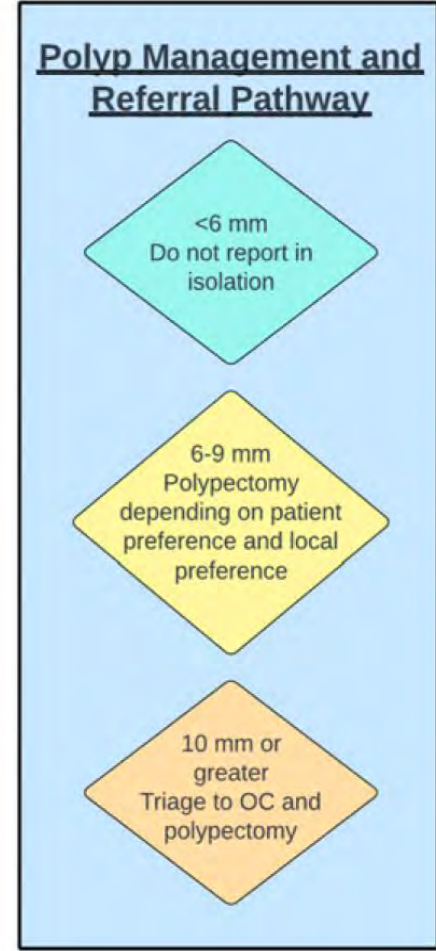
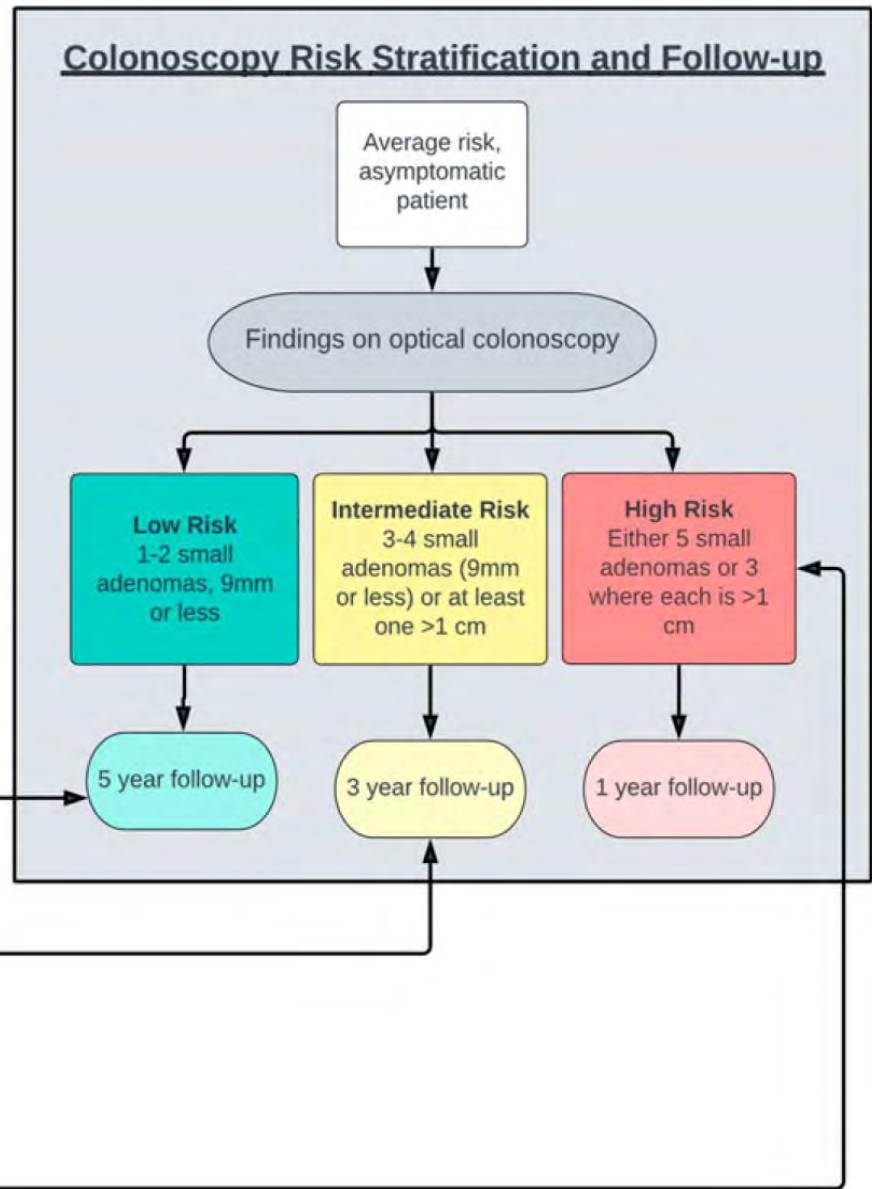
- polyp $\geq 10\text{mm}$
- 3 or more polyps, each 6-9 mm

Follow-up colonoscopy

C4 - Colonic mass, likely malignant

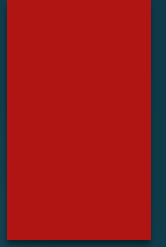
- lesion compromises bowel lumen, demonstrates extracolonic invasion

Surgical consultation



Chawla T, Hurrell C, Keough V, et al. Canadian Association of Radiologists Practice Guidelines for Computed Tomography Colonography. *Canadian Association of Radiologists Journal*. 2024;75(1):54-68.

ASSESSMENT OF GI MOTILITY



ASSESSMENT OF GI MOTILITY

- ▶ GI motility disorders fall under the larger category of functional GI disorders/disorders of gut-brain interaction
- ▶ Common
- ▶ Vague symptoms:
 - ▶ Dysphagia
 - ▶ Nausea +/- Vomiting
 - ▶ Early satiety
 - ▶ Bloating
 - ▶ Abdominal discomfort/pain
 - ▶ Diarrhea
 - ▶ Constipation

AVAILABLE DIAGNOSTIC TOOLS

- ▶ Endoscopy/colonoscopy, Barium studies to exclude mucosal abnormalities
- ▶ Gastric emptying breath test
- ▶ Wireless motility capsule
- ▶ Radiopaque markers
- ▶ Manometry
- ▶ US or MRCP (for biliary pathology)

AVAILABLE DIAGNOSTIC TOOLS

- ▶ Endoscopy/colonoscopy, Barium studies to exclude mucosal abnormalities
- ▶ Gastric emptying breath test
- ▶ Wireless motility capsule
- ▶ **Radiopaque markers (no longer available)**
- ▶ Manometry
- ▶ US or MRCP (for biliary pathology)

GI SCINTIGRAPHY

Indication	Esophageal	Gastric	SB	Colonic
Achalasia	x			
Esophageal stricture	x			
Suspected gastroparesis		x		
Symptoms of dumping syndrome		x		
Diabetes mellitus with new loss of glycemic control		x		
Severe refractory GERD		x		
Preoperative gastric fundoplication		x		
Chronic idiopathic intestinal pseudo-obstruction			x	x
Malabsorption syndrome			x	x
Celiac disease			x	x
Scleroderma	x		x	x
Chronic diarrhea			x	x
Functional dyspepsia		x	x	x
Chronic constipation		x	x	x
Assess response to therapy	x	x	x	x

GI SCINTIGRAPHY

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Functional dyspepsia		x	x	x
Chronic constipation		x	x	x
Assess response to therapy	x	x	x	x

GASTRIC EMPTYING STUDY

▶ Indications

- ▶ Gastroparesis/delayed gastric emptying
 - ▶ Nausea, vomiting, abdominal fullness, abdominal distention, early satiety
 - ▶ Associations: **advanced DM** , medications, post surgery (fundoplication, bariatric surgery)
 - ▶ Asymptomatic DM with poor glycemic control
- ▶ Severe GERD – delayed gastric emptying can increase acid levels and effect LES function
 - ▶ Assess before reflux surgery to determine needed for pyloroplasty
- ▶ Assessment prior to colectomy for constipation as gastroparesis (and delayed small bowel transit) may be co-existent – may not benefit from surgery
- ▶ Assess response to medical therapy (prokinetics)

GASTRIC EMPTYING STUDY

- ▶ Indications
 - ▶ Rapid Gastric emptying (“Dumping syndrome”)
 - ▶ Functional dyspepsia, impaired fundal accommodation, cyclic vomiting
 - ▶ Complication of early DM, post surgery

GASTRIC EMPTYING STUDY

- ▶ Solid vs liquid meal
- ▶ Solid emptying requires trituration in the antrum
- ▶ Liquid emptying primarily involves proximal to distal pressure gradient from fundal contraction
 - ▶ Can be abnormal even if solid study normal

GASTRIC EMPTYING STUDY

- ▶ Patient preparation
 - ▶ Medication history
 - ▶ Meds that impact motility held for 2 days, unless assessment while on medication requested
 - ▶ ?screening for cannabinoids
 - ▶ ? Hormonal impact – prefer to test during the first 10 days of menstrual cycle
 - ▶ ? No smoking on day of test

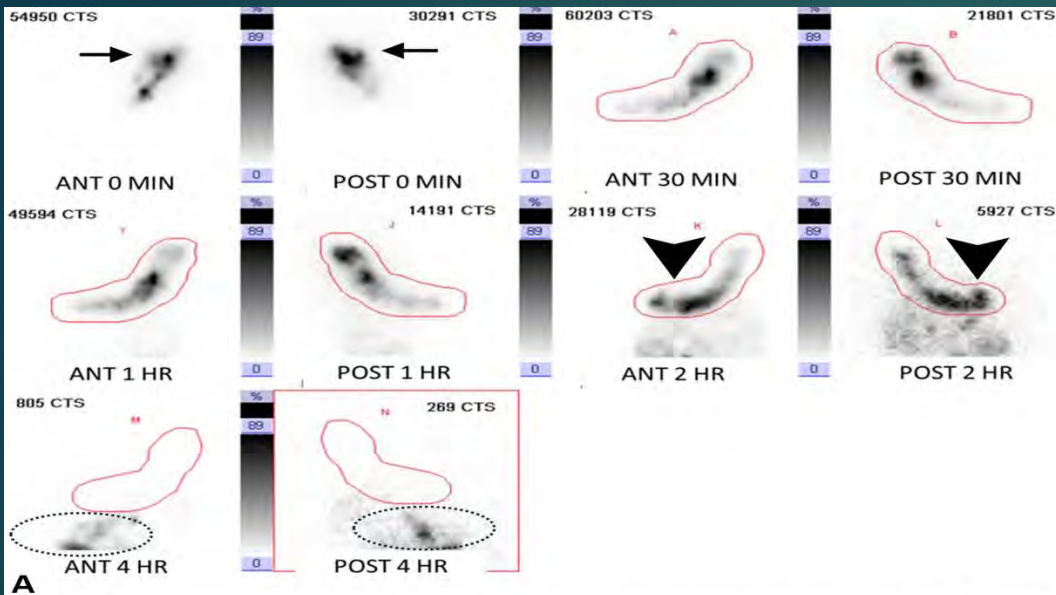
GASTRIC EMPTYING STUDY - SOLID

▶ Technique

- ▶ Standard meal: 4 oz liquid egg white labelled with Technetium sulfur colloid (then cooked), two slices of white bread, 30 g strawberry jam
 - ▶ Standard calories, balance of carbs, protein, fibre
- ▶ Ingested as an egg sandwich with the water
 - ▶ Needs to be eaten within 10 minutes
 - ▶ Prolonged or incomplete ingestion documented, emesis noted
 - ▶ Need at least 50% of meal ingested

GASTRIC EMPTYING STUDY

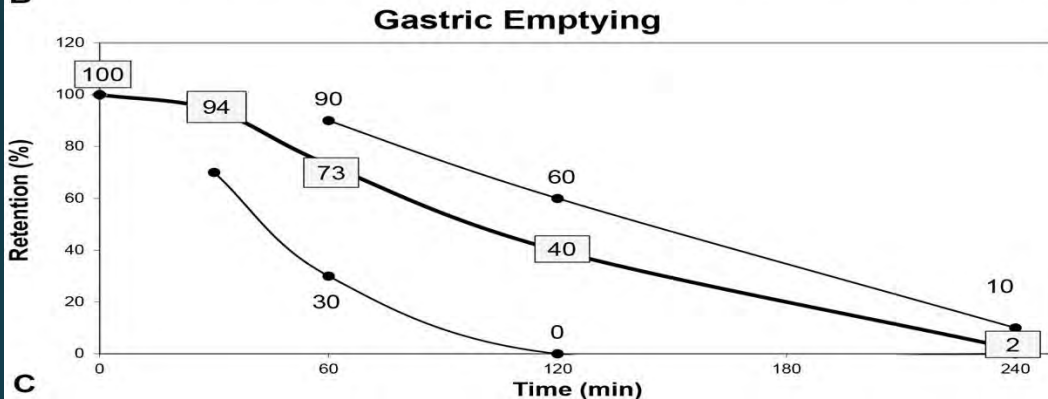
- ▶ Upright images obtained immediately after meal consumed (time 0), then at 1 hour, 2 hours, 4 hours
 - ▶ 30-minute acquisition helpful to assess rapid gastric emptying
- ▶ Results graphed over time



A

Time to be Imaged	Time Imaged	Time Elapsed	Anterior Counts	Posterior Counts	% Retained (Patient)	Normal Low	Normal High
0 min	0852 AM	0	54950	30291	100	100	100
30 min	0922 AM	30	60230	21801	94	70	
60 min	0952 AM	60	49594	14191	73	30	90
120 min	1052 AM	120	28119	5927	40	0	60
240 min	1252 PM	240	805	269	2	0	10

B

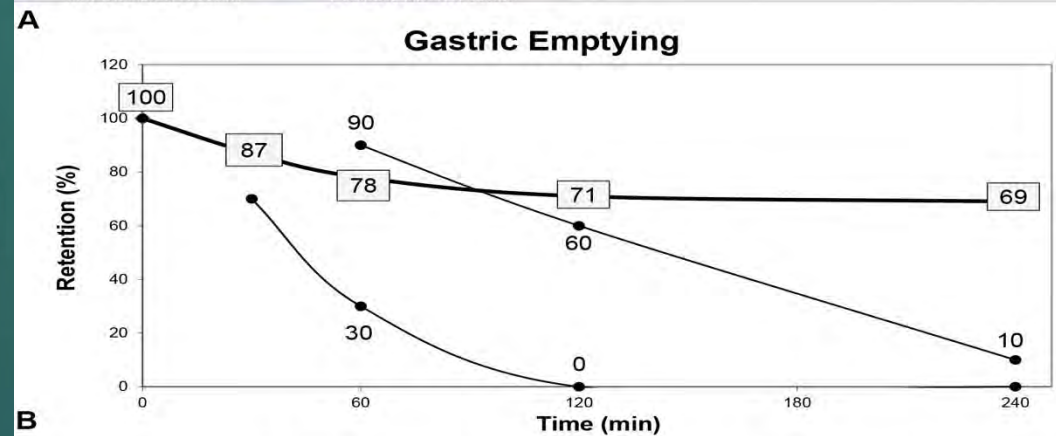
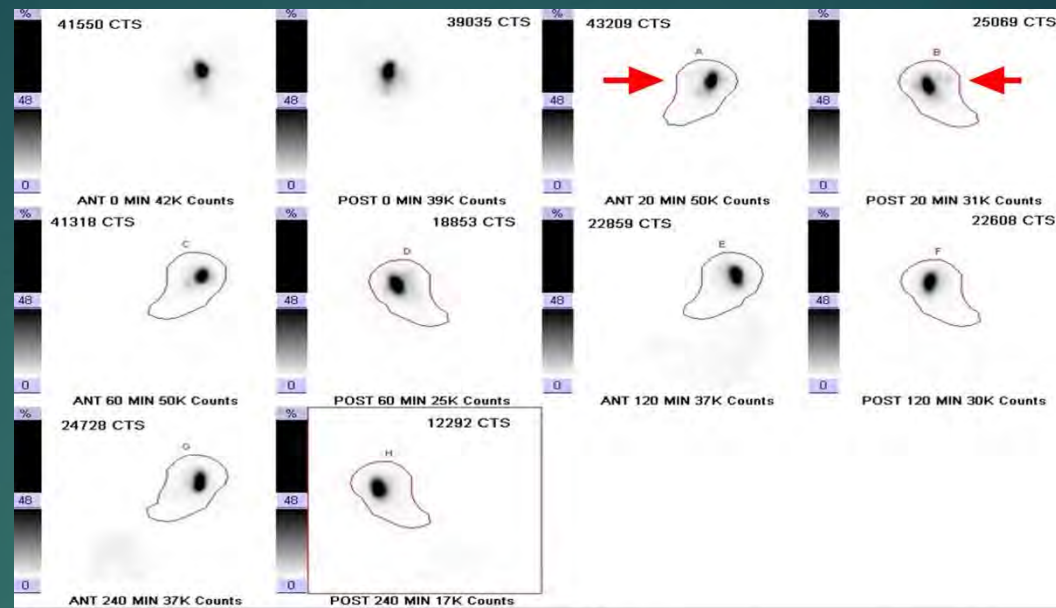


C

NORMAL STUDY

- ▶ Delayed gastric emptying
 - ▶ > 60% retention at 2 hours
 - ▶ > 10% retention at 4 hours
- ▶ Look at pattern of retained activity (fundal vs. antral)

FUNDAL DYSFUNCTION

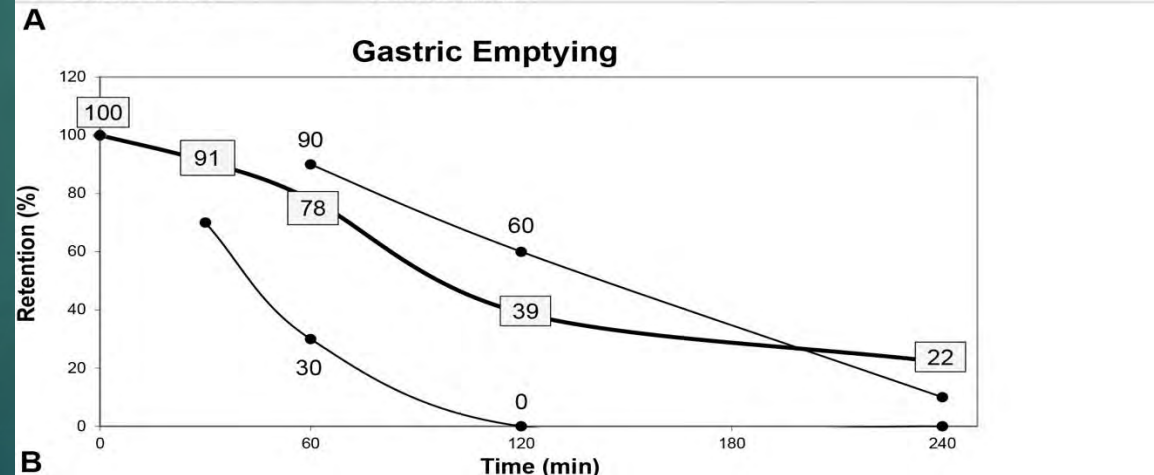
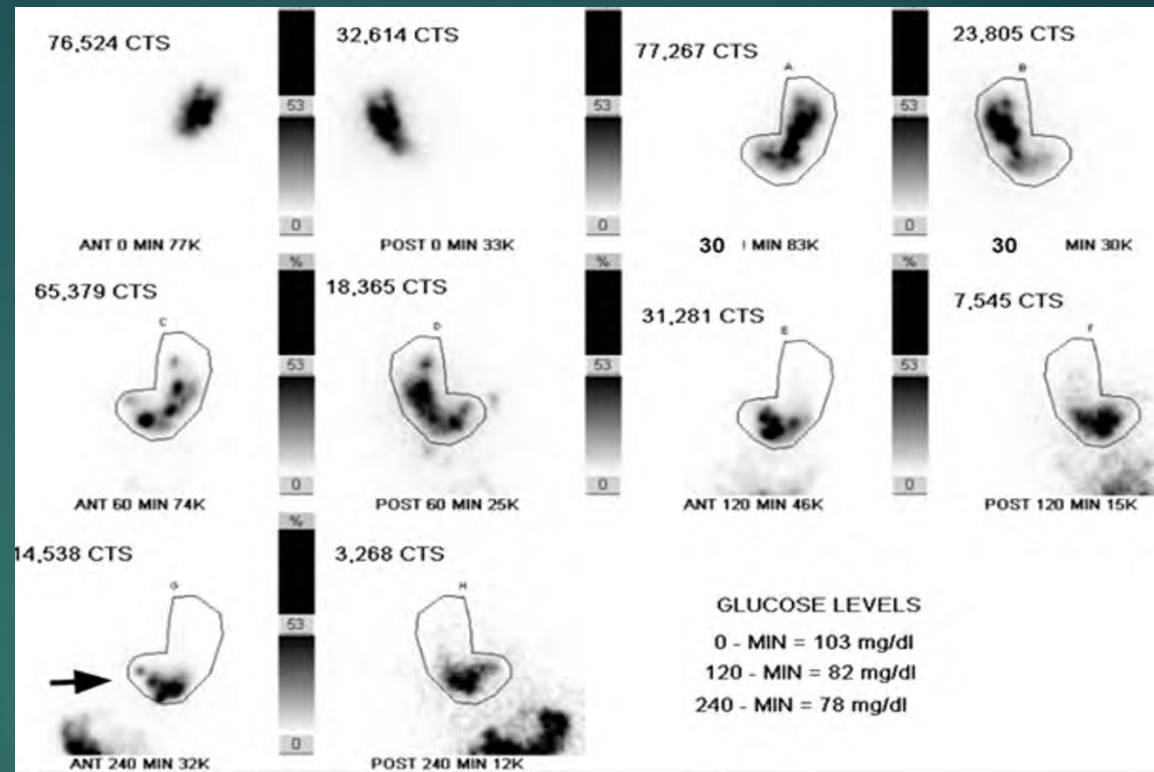


B

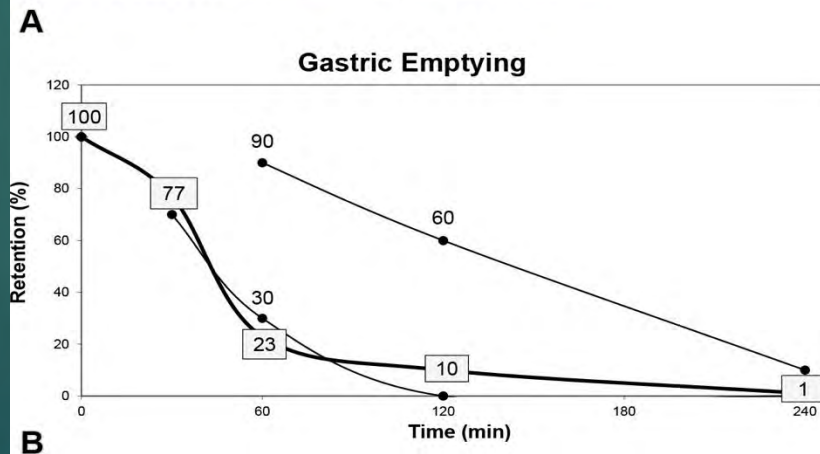
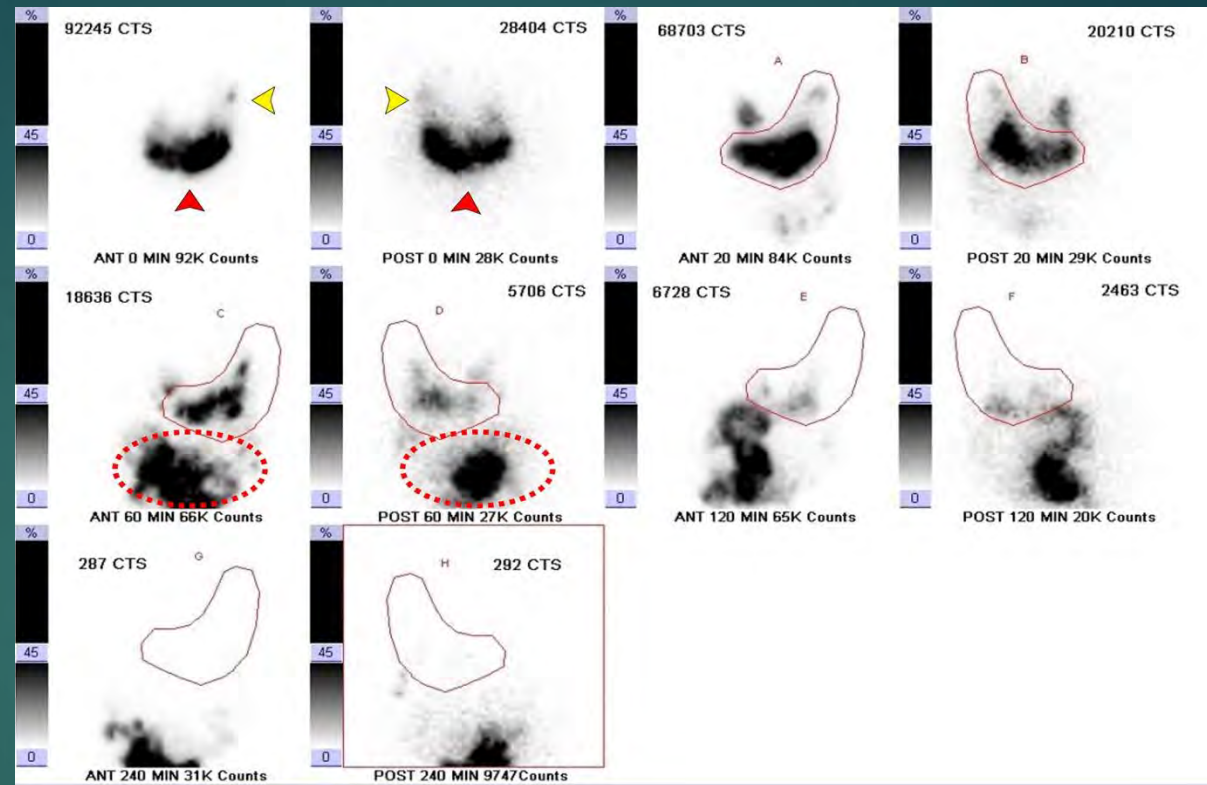
Time to be Imaged	Time Imaged	Time Elapsed	Anterior Counts	Posterior Counts	% Retained (Patient)	Normal Low	Normal High
0 min	0855 AM	0	41550	39035	100	100	100
30 min	0927 AM	30	43209	25069	87	70	
60 min	0955 AM	60	41318	18853	78	30	90
120 min	1055 AM	120	22859	22608	71	0	60
240 min	1255 PM	240	24728	12292	69	0	10

C

ANTRAL DYSFUNCTION



Rapid Gastric emptying due to impaired fundal accommodation



GASTRIC EMPTYING STUDY

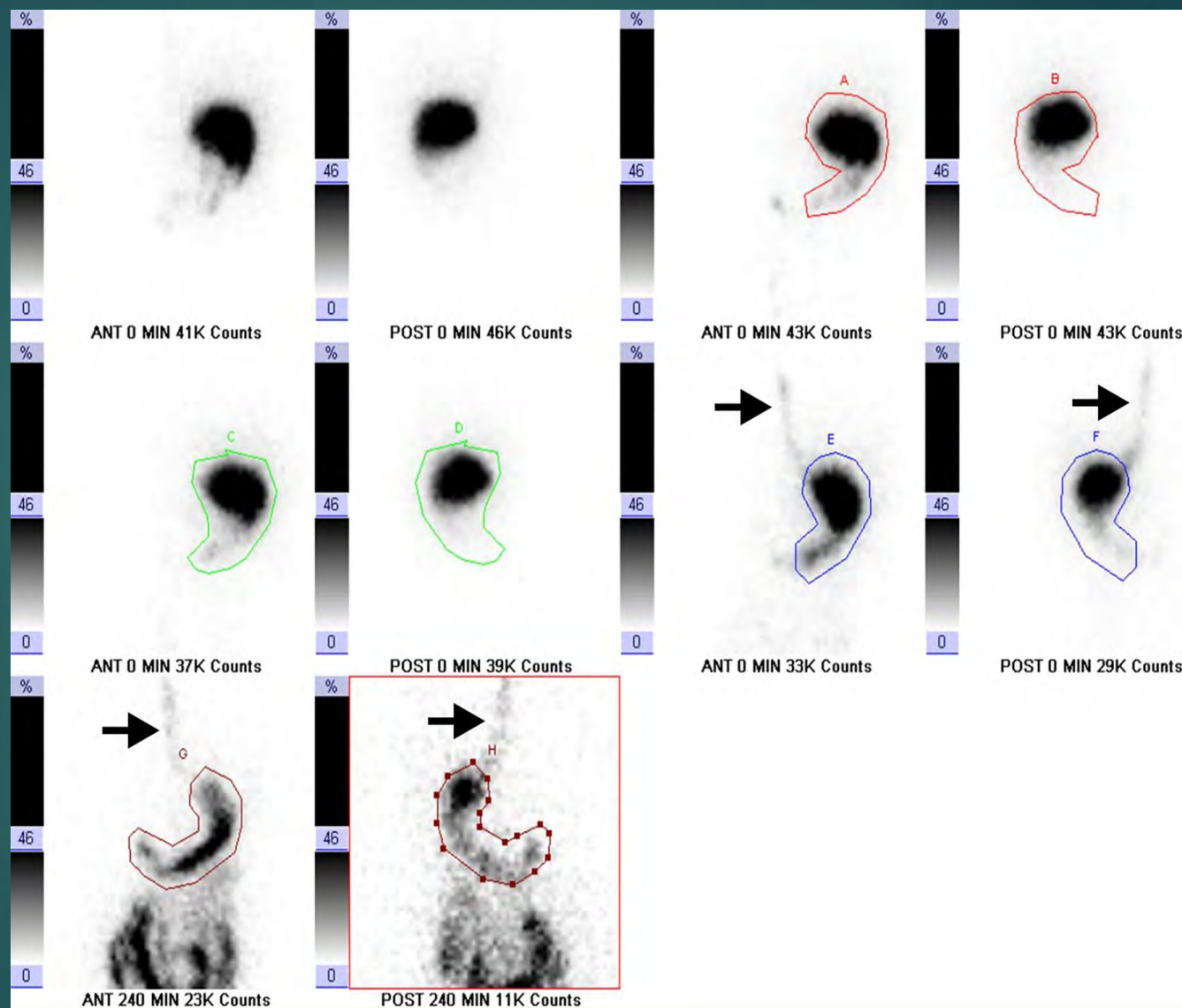
- ▶ Advantages:
 - ▶ Physiologic
 - ▶ Single day study
 - ▶ Low radiation dose (less than $\frac{1}{2}$ of an abdominal x-ray)
 - ▶ Non-invasive
 - ▶ Uses common foods
 - ▶ Quantitative
 - ▶ Can see intragastric movement of meal

GASTRIC EMPTYING STUDY

- ▶ Limitations

- ▶ Not all patient tolerate standard meal (consists of egg, gluten)
 - ▶ Alternate meals exist, but aren't as well validated
 - ▶ Vomiting, reflux, Incomplete ingestion of the meal
- ▶ Undisclosed interfering medications (cannabinoids?)
- ▶ Use of different meals/protocols limits comparisons

Severe reflux reduces activity in stomach and falsely increases degree of gastric emptying



SMALL BOWEL SCINTIGRAPHY

- ▶ 10% of patients with dyspepsia have slow small bowel transit
- ▶ >25% of patients with constipation have gastric or small bowel motility issues
- ▶ Diagnosis of small bowel motility disorder changes diagnosis in up to half of patient, impacts management in 2/3 of patients

SMALL BOWEL SCINTIGRAPHY

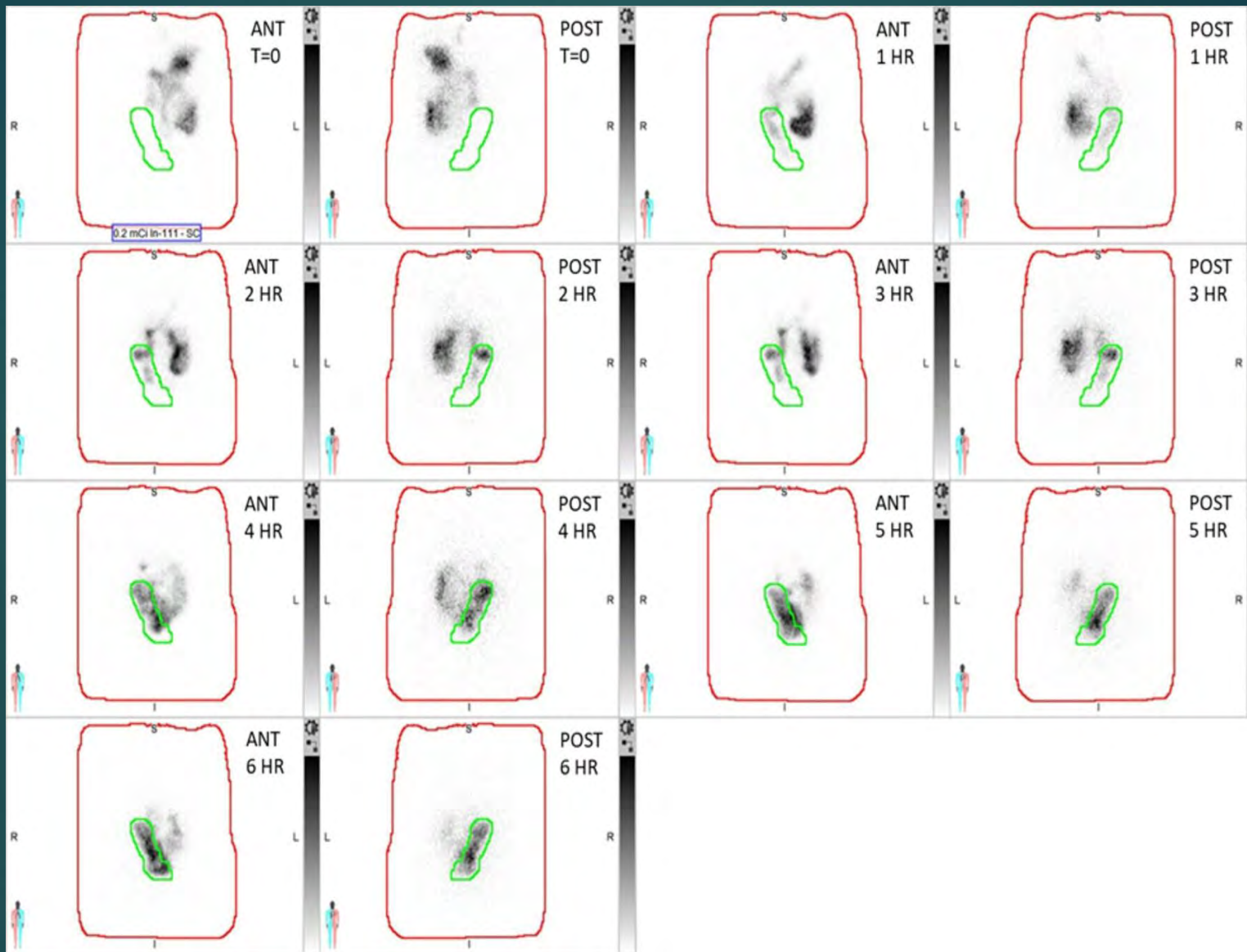
▶ Technique

- ▶ 300 mL of water labelled with radiotracer – give with unlabeled solid food to mimic normal meal
- ▶ Images are acquired for immediately, then every hour, up to 6 hours, can do 24- hour image, if required
- ▶ Need >50% of activity to empty from stomach at 2 hours to do small bowel assessment (cannot interpret with severe gastric retention)
- ▶ Assessment of transit based on filling of the terminal ileum (the terminal ileum reservoir – TIR) at 6 hours

SMALL BOWEL SCINTIGRAPHY

▶ Interpretation

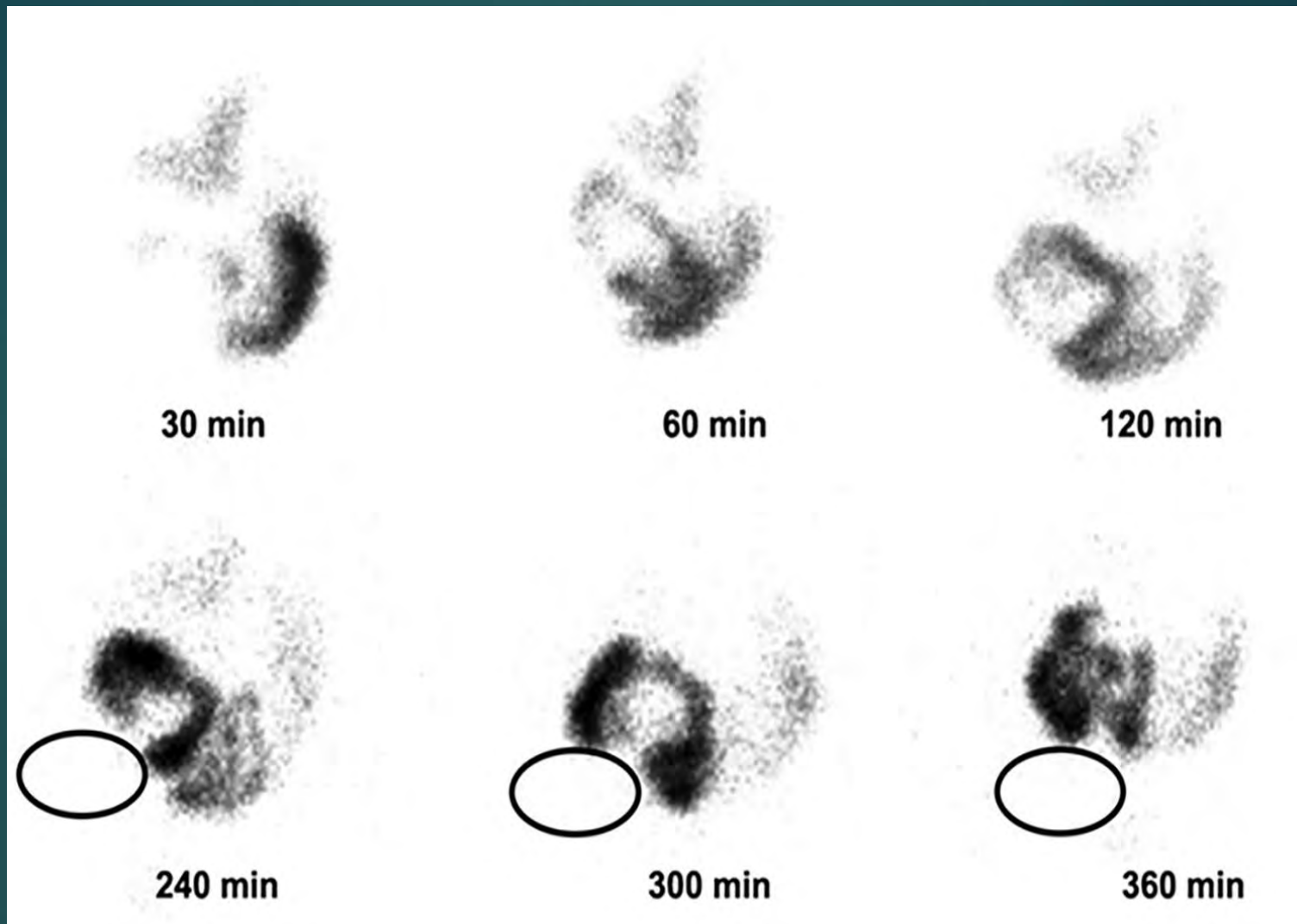
- ▶ > 40% activity at TIR/colon by 6 hours, or >10% activity in colon
- ▶ Delayed transit results in most of the activity still in the remainder of the abdomen (>50%)
- ▶ Rapid small bowel transit is >10% activity in cecum/colon at 1 hour



Normal small bowel transit with >50% activity in TIR at 6 hours

Banks KP. Published Online: May 30, 2024

<https://doi.org/10.1148/rg.230127>

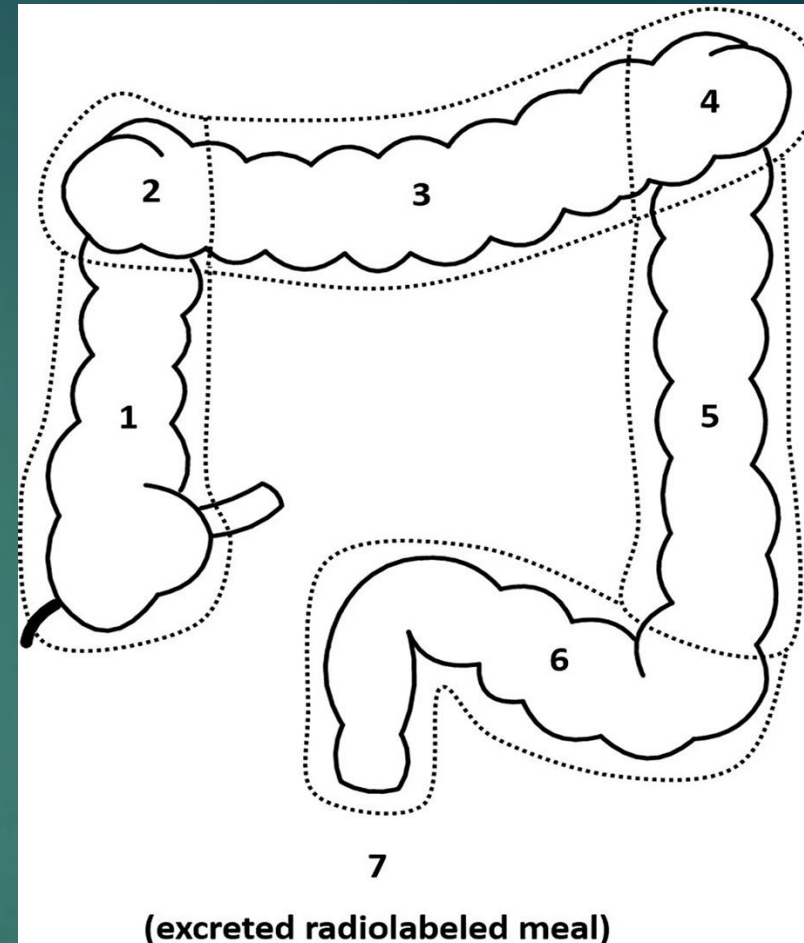


Delayed small bowel transit

COLONIC TRANSIT SCINTIGRAPHY

- ▶ Technique
 - ▶ Similar to small bowel, radiotracer labelled water with solid meal
 - ▶ Initial imaging at 6 hours (baseline), then at 24 hours, 48 hours and 72 hours
 - ▶ Later imaging helps define sites of functional obstruction
 - ▶ Colon divided into 6 segments, labelled 1-6
 - ▶ These are weighting factors for the counts in each segment

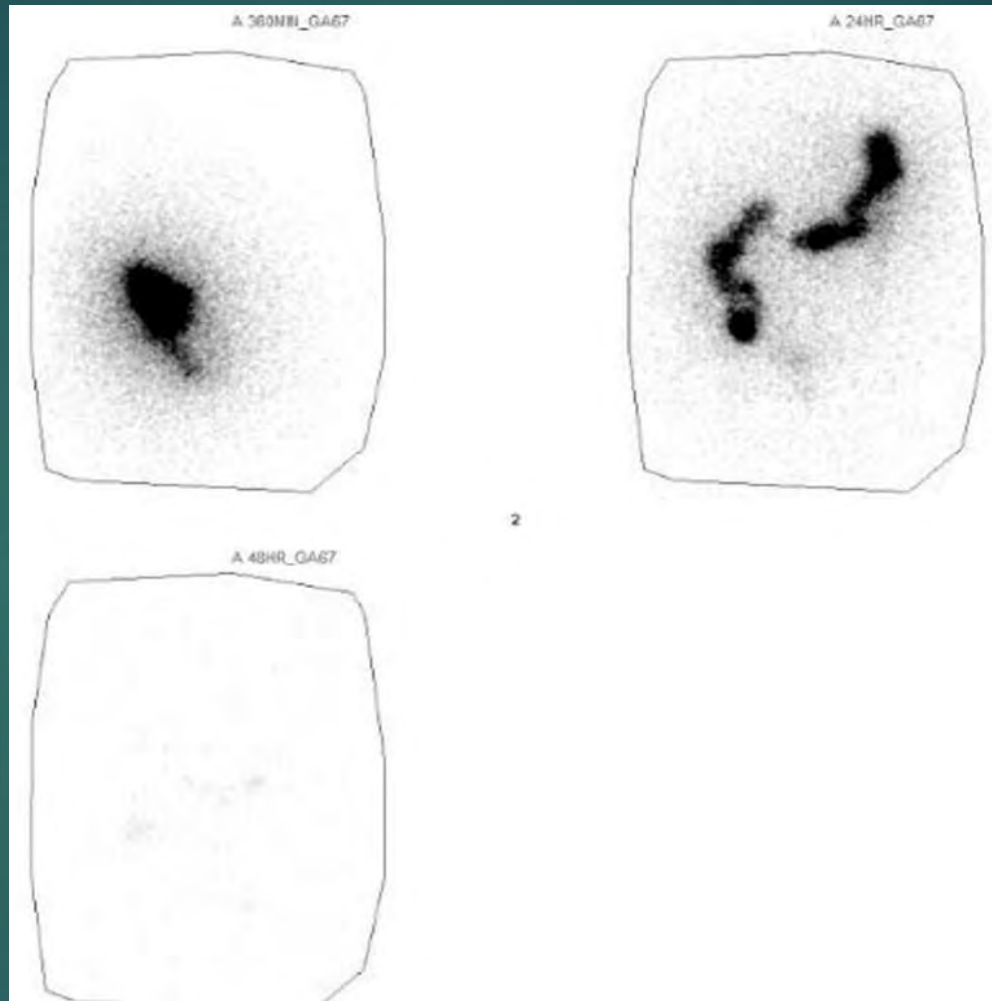
CECUM AND ASCENDING COLON	1
HEPATIC FLEXURE	2
TRANSVERSE COLON	3
SPLENIC FLEXURE	4
DESCENDING COLON	5
RECTOSIGMOID COLON	6



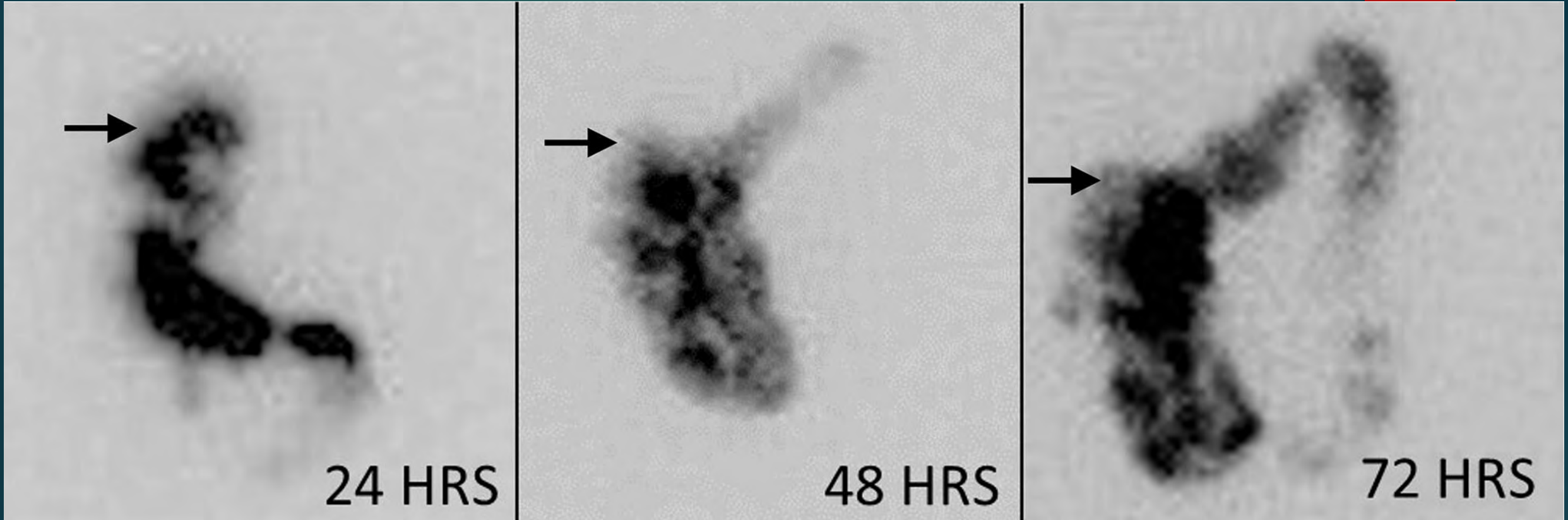
Excreted meal is labelled "7", calculated as: (Initial count) – (retained count in colon)

COLONIC TRANSIT SCINTIGRAPHY

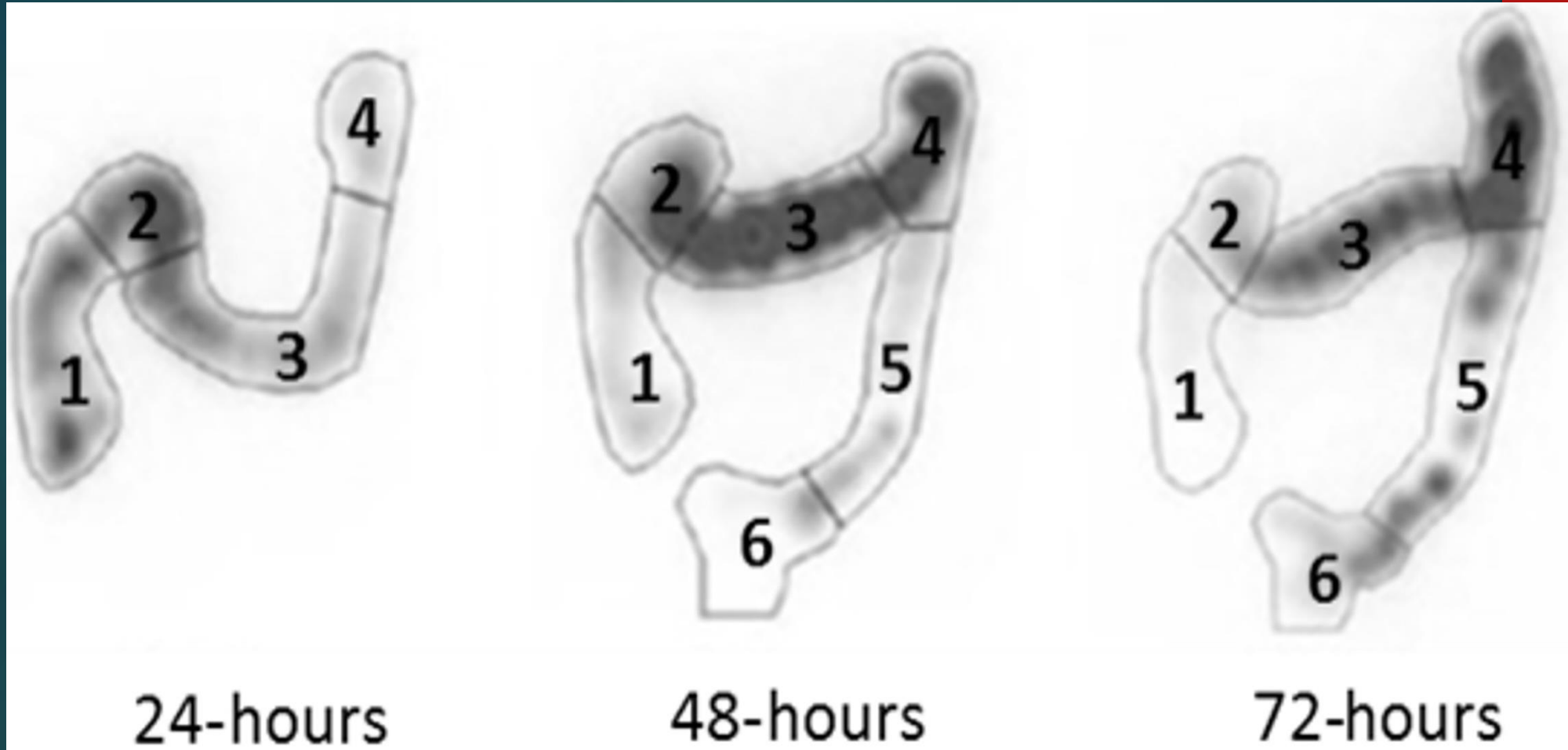
- ▶ Interpretation
 - ▶ Progression of activity from proximal to distal colon
 - ▶ > 67% activity evacuated by 72 hours



NORMAL COLONIC TRANSIT – COMPLETE (100%) EMPTYING BY 48 HOURS



COLONIC INERTIA – LITTLE ACTIVITY BEYOND SPLENIC FLEXURE



GENERALIZED COLONIC DELAY WITH DIFFUSE RETAINED ACTIVITY AT 72 HOURS



FUNCTIONAL OUTLET OBSTRUCTION – RETAINED ACTIVITY IN SIGMOID COLON AT 72 HOURS

WHOLE GI TRACT IMAGING

- ▶ Protocols to image the entire GI tract simultaneously exist
- ▶ Consider assessing whole bowel in patient with gastric emptying issues
- ▶ There are single day protocols but not used routinely as can be onerous for patients

Whew!



GI RADIOLOGY UPDATE

- ▶ Reviewed
 - ▶ Ongoing utility of fluoroscopic studies
 - ▶ CTE vs MRE
 - ▶ Imaging options for GIB
 - ▶ CT colonography
 - ▶ GI scintigraphy for bowel motility

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Questions?

