A Case of Colon Cancer

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Diagnostic Radiology 4001-7

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Clinical History

- 51 y.o. male with PMH of hypertension and colonic polyps who presenting with diarrhea for several months.
- Current Symptoms:
  - Bloating, loose stools three times a day, back pain.
  - Weight loss of 7 lbs.
  - No rectal bleeding or abdominal pain
- Physical Exam Findings:
  - Stable Vital Signs: T: 98.2, HR: 94, BP: 119/82, RR: 16,
  - Abdominal Exam: soft, nontender to palpation, no palpable masses.
- Work-Up:
  - CBC with differential: anemia with Hgb of 11.6 and Hct 37.5, albumin 3.1.
  - Carcinoembryonic Antigen 1.6[1].
  - LFTs within normal limits
  - Colonoscopy displayed soft tissue mass at 70 cm. Mass was tattooed and polyp removed.

ACR Appropriateness Criteria

- Colorectal Cancer: mass visualized and tattooed on colonoscopy and notable HPI
- Imaging Appropriate [2]

Variant 2: **Colorectal cancer. Staging for distant metastases.**

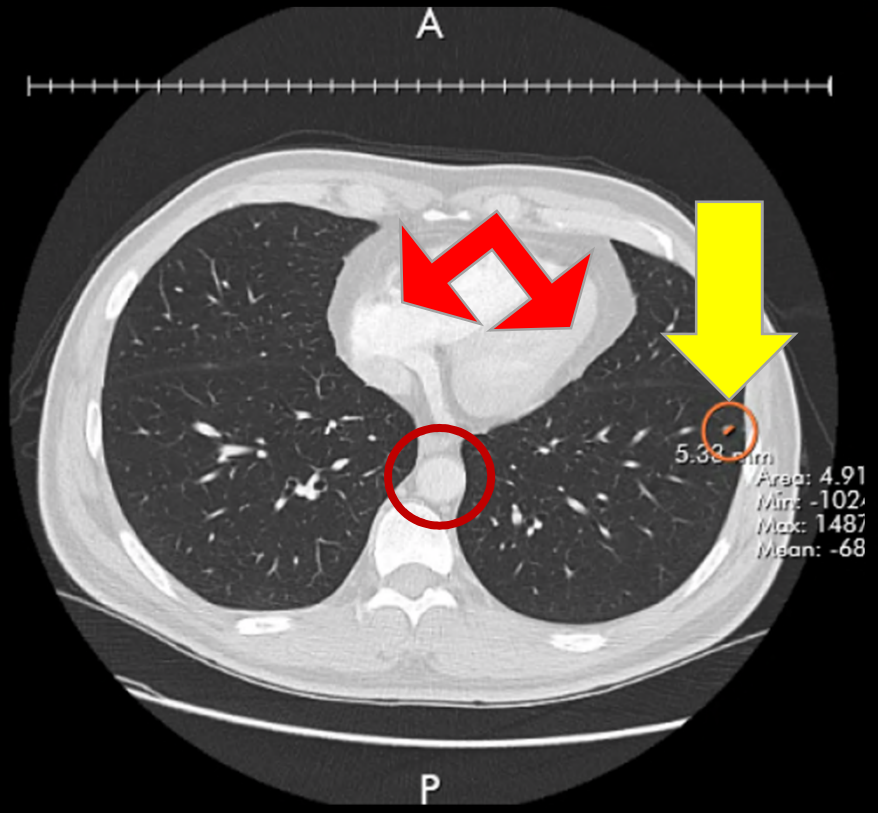
Radiologic Procedure	Rating	Comments	RRL*
CT chest abdomen pelvis with IV contrast	9		☢☢☢☢
MRI abdomen and pelvis without and with IV contrast	8	MRI or CT can be used. Usually performed along with a chest CT.	O
FDG-PET/CT whole body	6		☢☢☢☢
MRI abdomen and pelvis without IV contrast	5	Rarely used, but may be appropriate in situations when other exams cannot be performed due to contraindications. Usually performed along with chest CT.	O
CT chest abdomen pelvis without IV contrast	4	Only useful in a few very specific situations.	☢☢☢☢
CT chest abdomen pelvis without and with IV contrast	3	Limited added value of non-contrast series at the expense of increased dose.	☢☢☢☢

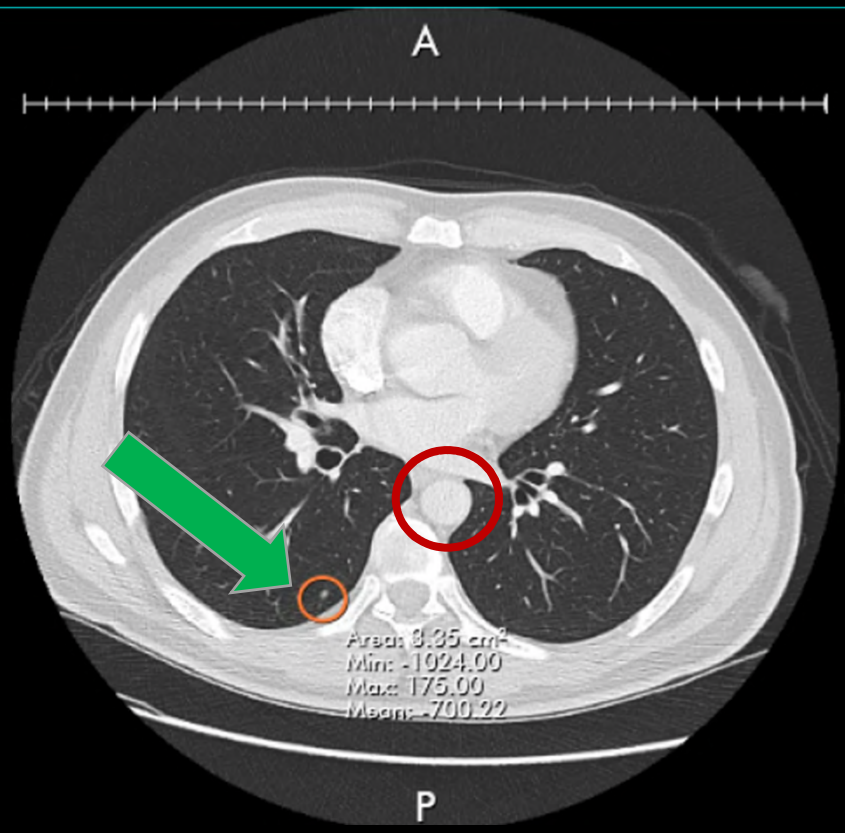
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

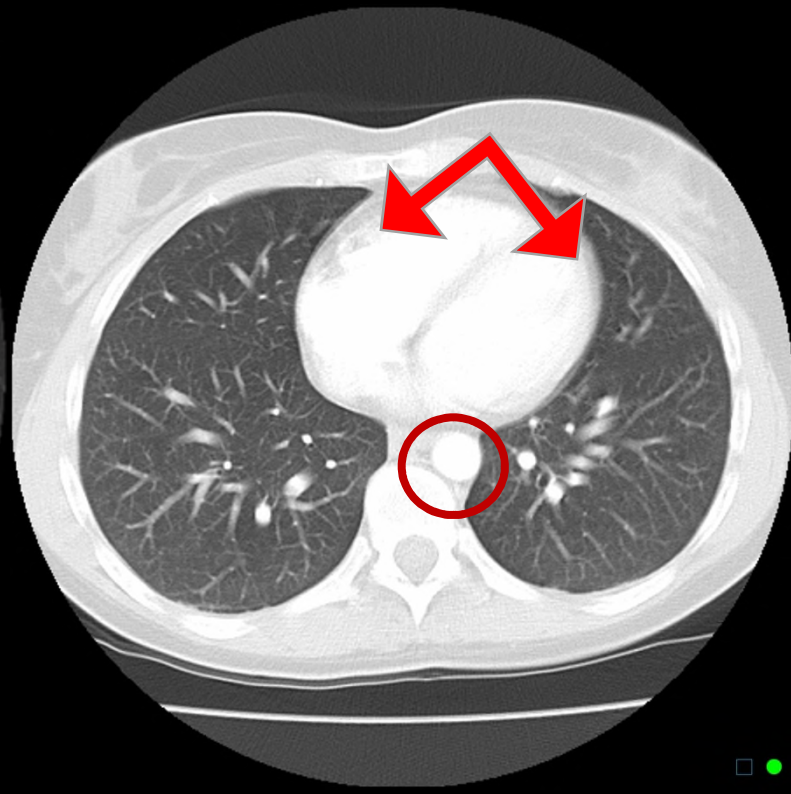
*Relative Radiation Level

CT Chest

- 10/18/19: CT chest w/ contrast – axial views





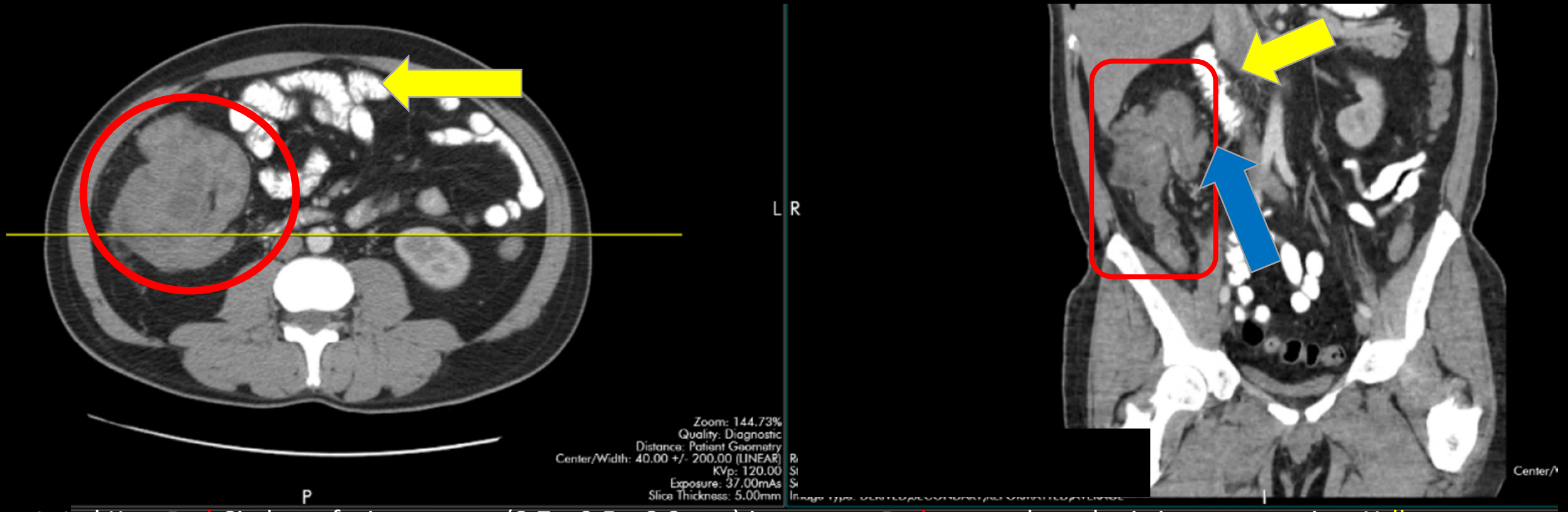


Label Key; Yellow arrows 5 mm nodule. Green arrow 4 mm nodule. Red Circle: Aorta
Red Arrows: ventricles

Normal Chest CT[4]

CT Abdomen and Pelvis

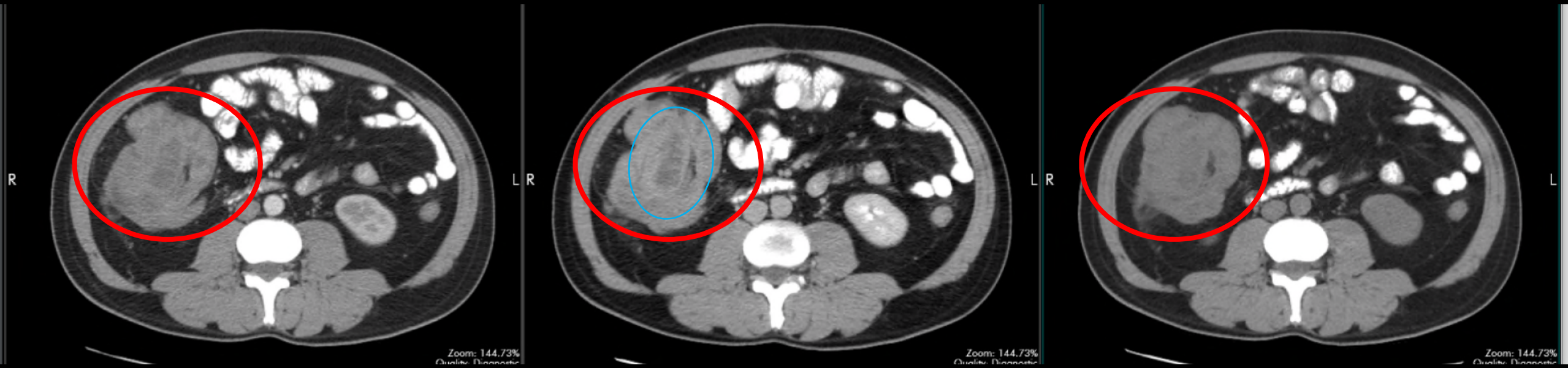
- 10/18/19 – CT abdomen and pelvis w/ contrast, axial and coronal views



Label Key: Red Circle: soft tissue mass (8.7 x 9.5 x 8.3 cm) in cecum. Red rectangle: colonic intussusception. Yellow arrows: small bowel with contrast. Blue arrow: ileocecal junction.

CT Abdomen and Pelvis

- 10/18/19 – CT abdomen and pelvis w/ contrast, delay, and w/o contrast, axial



Label Key: Red Circle: soft tissue mass (8.7 x 9.5 x 8.3 cm) in cecum. Blue Circle: telescoping of bowel.

Summary of Key Image Findings

- Patient Presentation of Chronic Diarrhea, bloating, and back pain.
  - No abdominal pain or rectal bleeding
- Key Imaging Findings:
  - Chest CT with Contrast : two pulmonary nodules measuring 4 and 5 mm
  - Abdominal and Pelvic CT with contrast : axial and coronal views show large non-obstructing soft tissue mass
    - Soft tissue mass acts as lead point for intussusception of cecum
  - Normal liver findings

Causes of a colonic mass
Malignant lesions
Adenocarcinoma
Lymphoma
Carcinoid tumor
Kaposi sarcoma
Prostate cancer
Benign lesions
Crohn colitis
Diverticulitis
Endometriosis
Solitary rectal ulcer
Lipoma
Tuberculosis
Amebiasis
Cytomegalovirus
Fungal infection
Nematode (roundworm) infection
Extrinsic lesion

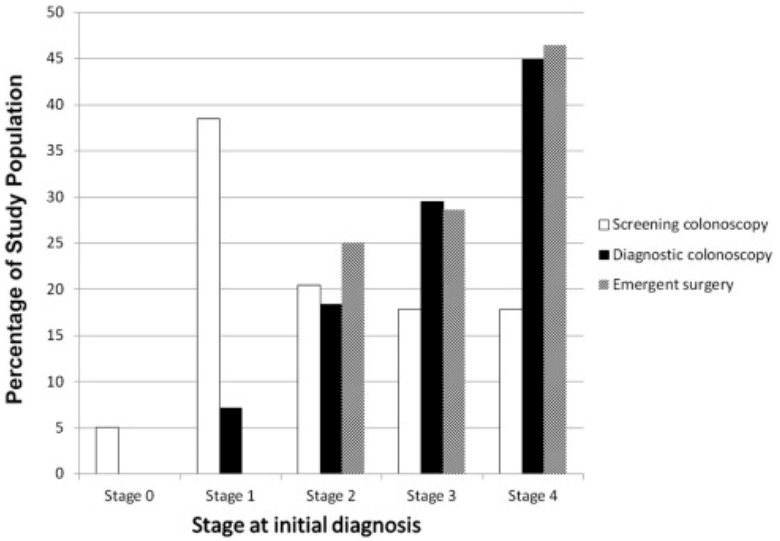
Differential Diagnosis

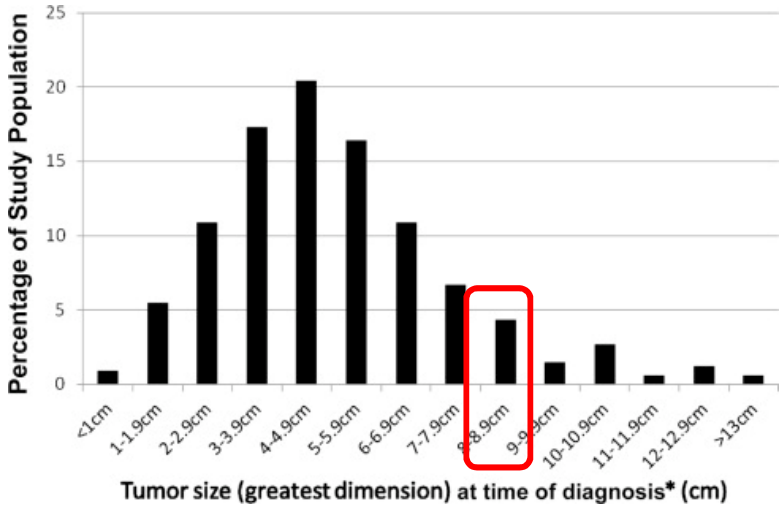
- Adenocarcinoma = Most likely diagnosis
- Lymphoma
  - Primary colonic lymphoma is rare
  - Non-Hodkin's lymphoma of the colon – Mantle Cell Lymphoma[5]
    - Extranodal sites like the GI tract are common
    - Incidence increases with age and male predominance
  - No other B-symptoms or lymphatic involvement
- Metastasis from other malignancies such as prostate cancer unlikely due to lack of symptoms and CT imaging showing no other colonic involvement or abdominal involvement.

Discussion: Adenocarcinoma

- Local tumor symptoms[6]:
  - Changes in bowel habits
  - Anemia
  - Abdominal mass
  - PMH of colonic polyps
- Symptoms not prognostic but those that present with symptoms prior to diagnosis tend to have more advanced disease[7]
- Incidence increases with age
- Diagnosis then begins with either screening or diagnostic colonoscopy

Abnormality Resulting in Diagnostic Colonoscopy	Percentage of Patients (n)
Blood per Rectum	36.5 (114)
Abdominal Pain	33.7 (105)
Anemia	22.8 (71)
Incidental Colonic Hypermetabolic Activity Detected on PET CT Imaging	1.9 (6)
Diarrhea	1.3 (4)
Abnormal Liver Function Tests	1.0 (3)
Brain Metastasis, Colorectal Primary	0.6 (2)
Abnormal Chest Radiograph With Lung Metastases	0.6 (2)
Hematuria With Colovesicle Fistula	0.3 (1)
Hepatic Flexure Mass Seen on MRI Done to Evaluate Fibroids	0.3 (1)
Rectal Mass on Physical Examination	0.3 (1)
Scrotal Bleeding, Colonic Mass Identified on CT Scan Performed To Evaluate for Etiology of Scrotal Bleeding	0.3 (1)
Upper Extremity Deep Vein Thrombus, Colonic Mass Identified on CT Scan Performed to Search For Malignancy as a Potential Etiology of Deep Vein Thrombus	0.3 (1)





Discussion: Adenocarcinoma

- Staging done by the TMN staging system
- Preoperative staging usually done by physical exam and CT.
  - Staging not specified but likely not stage IV
- Tumor size large at time of diagnosis
  - Now causing partial obstruction
- Further testing planned for staging

Further Work-Up: PET CT Skull Base to Mid Thigh

- ACR Appropriateness Criteria states it was appropriate:

Variant 2: **Colorectal cancer. Staging for distant metastases.**

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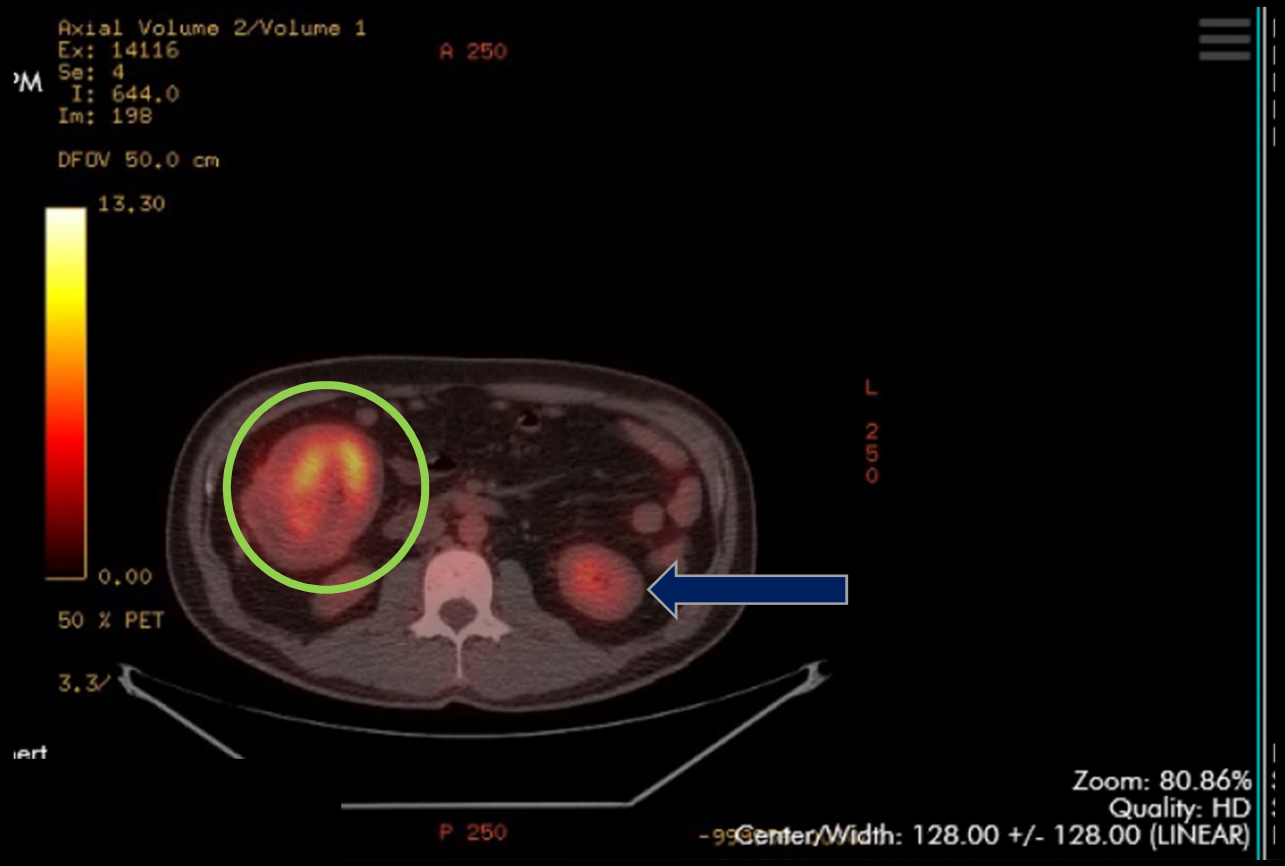
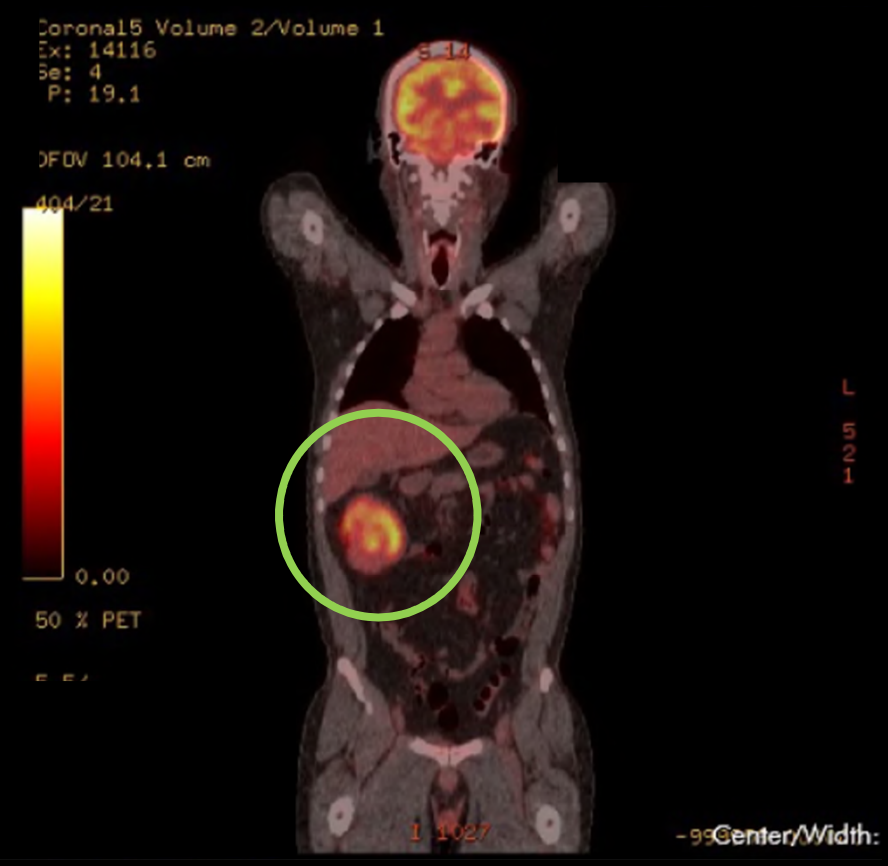
Rating Scale: **1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate**

***Relative Radiation Level**

PET CT Skull Base to Mid Thigh

10/28/19 – Axial and Coronal views of primary tumor

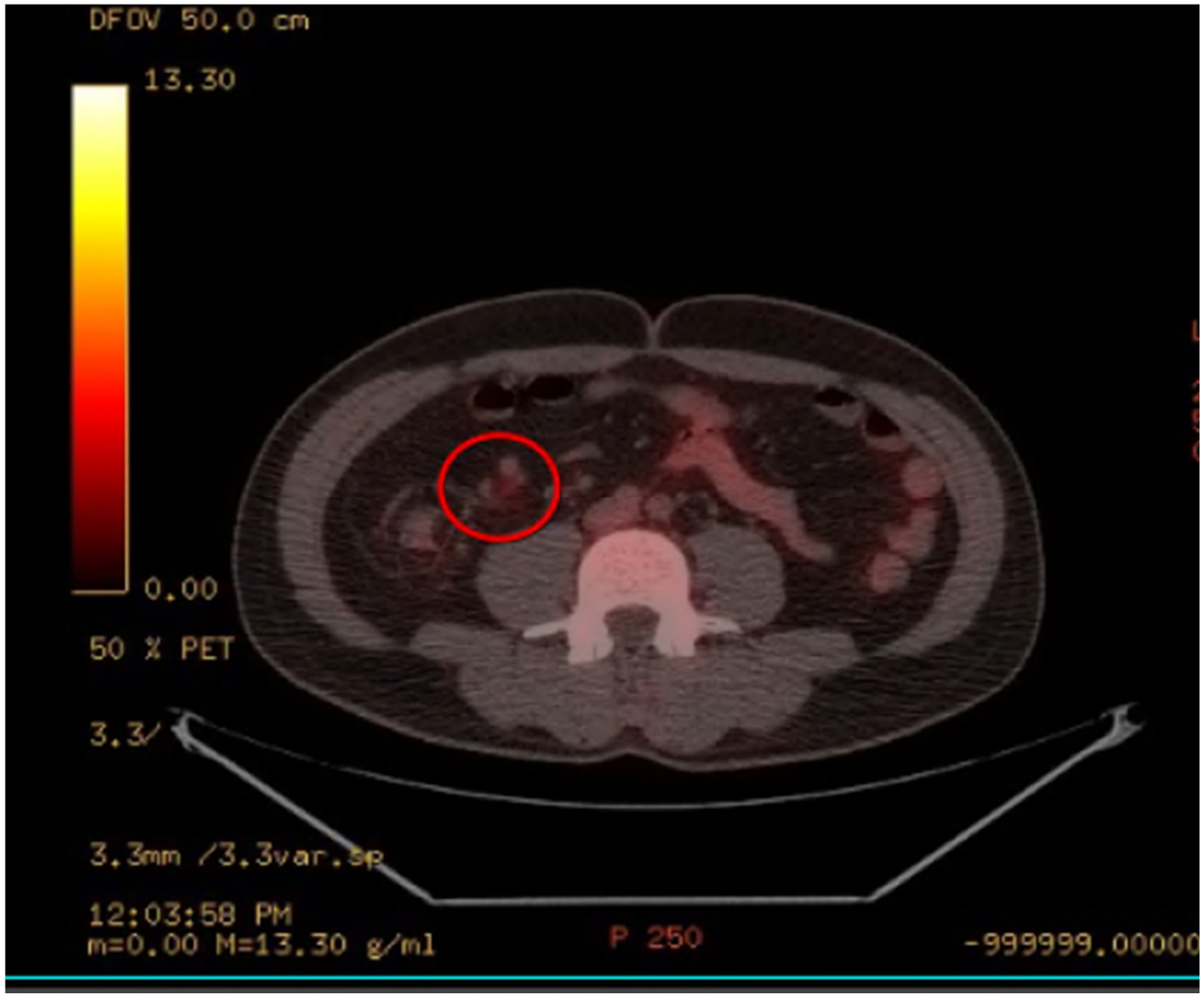




Green Circle: colonic mass. Blue arrow – kidney

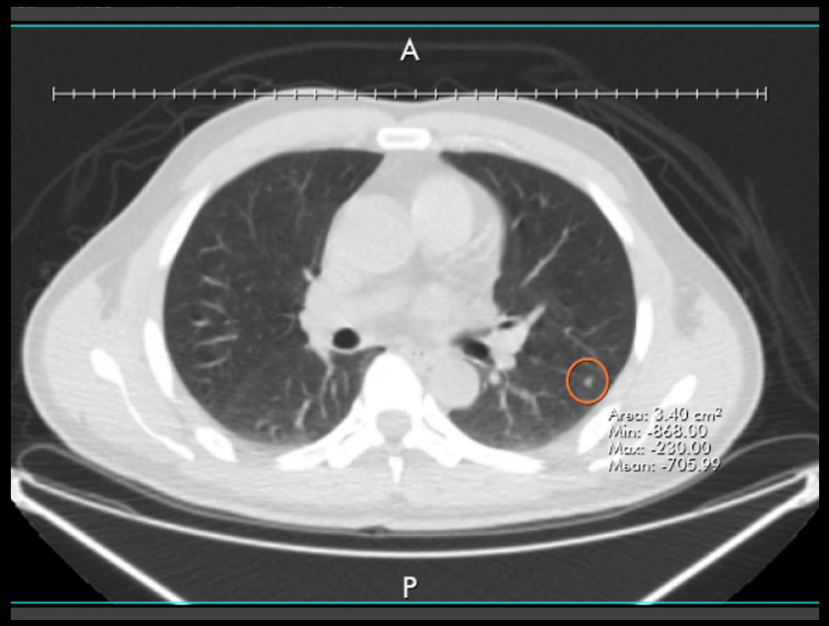
PET CT Skull Base to Mid Thigh 10/28/19 – Axial view of lymph node

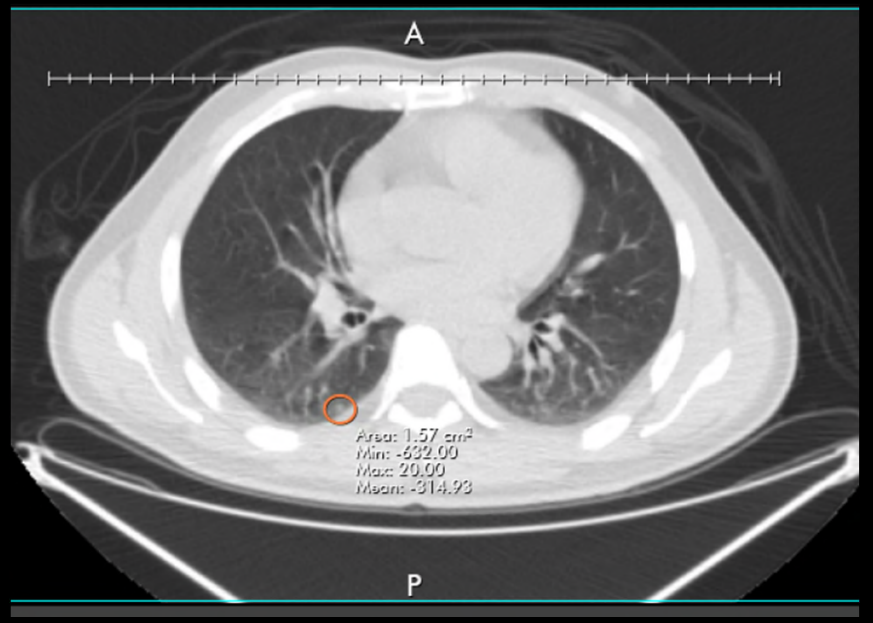
- Red Circle – mesenteric lymph node
  - Most prominent
  - Suspicious for metastatic involvement
- No other evidence of FDG avid lymphadenopathy



PET CT Skull Base to Mid Thigh

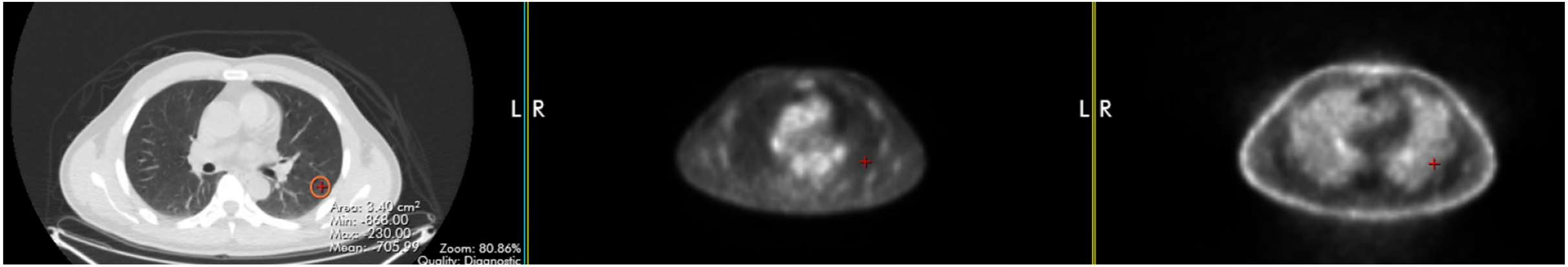
10/28/19 – Axial view of pulmonary nodules CT w/o contrast





Orange Circle: Pulmonary nodules

PET CT Skull Base to Mid Thigh
10/28/19 – Axial view of pulmonary nodules CT w/o contrast,



CT without contrast

PET with attenuation correction

PET without attenuation correction

Red Cross: nodule

PET CT Pulmonary Nodule Sensitivity

- Uptake of FDG (fluorodeoxyglucose) in the PET CT imaging study may help in differentiating between malignant and benign pulmonary nodules.
- In solid nodules, tracer avidity is limited in nodules <8mm. PET /CT mostly used to detect metastasis and to check for potential biopsy sites.
  - The nodules found in this patient were 4-7 mm.
  - PET demonstrates sensitivity of 89% and specificity of 75%
- In semisolid or subsolid lesions, PET/CT only has sensitivity and specificity of 10 and 20 percent, respectively.
- An SUV >2.5 is used to differentiate pulmonary nodules that have a high probability of malignant
  - However, infection and inflammation can reduce sensitivity due to increased FDG uptake by tissues.

Next Steps

- From the imaging findings between the CT and PET scans, options were discussed with the patient.
- Through the TNM staging process, patient's malignancy may measure between IIC and IIIA due to possible metastatic involvement of mesenteric lymph nodes. Pulmonary nodules ultimately believed to be benign.
- Open right colectomy was recommended due to size of the tumor in the ascending colon and samples would be taken for pathological study.

Final Diagnosis

- Right sided colectomy was performed and mass was removed from the ascending colon.
  - Handsewn ileocolic anastomosis was performed
- Surgical pathology confirmed well-differentiated invasive mucinous adenocarcinoma of the terminal ileum extending to subserosa measuring 10.9 x 8.9 x 4.7 cm.
  - One mesenteric lymph node confirmed for metastatic involvement
  - Stage: pT3, N1, MX

Histology	Percentage of Patients (n)
Adenocarcinoma	83.1 (409)
Mucinous Adenocarcinoma	10.0 (49)
Adenocarcinoma With Signet Ring Features	1.2 (6)
Adenocarcinoma With Signet Ring and Mucinous Features	1.0 (5)
Adenocarcinoma With Neuroendocrine Features	0.6 (3)
Neuroendocrine Tumor	0.6 (3)
Adenocarcinoma With Medullary Features	0.4 (2)
Mesenchymal Tumor	0.2 (1)
Unavailable	2.8 (14)

Treatment

- Surgery usually curative for localized malignancies. Tumor was removed.
  - Right hemicolectomy usually performed for cancer of the cecum and ascending colon with anastomosis performed if uncomplicated.
- Patient will continue to be on anti-DVT prophylaxis following surgery as well as medications for pain-management
- Other treatment options can be neoadjuvant chemoradiotherapy or chemotherapy
  - However, data is limited and increases treatment-related toxicity

Cost of Imaging Services

- At Memorial Herrman TMC Uninsured = $4,623

Ct Chest W/Con	$1,417
Ct Pelvis/Abdomen W/O-W C	$3,206

- At Memorial Herrman TMC Insured = Total: 12,842, Avg Patient Responsible for $ 819

Ct Chest W/Con	$3,936	$432
Ct Pelvis/Abdomen W/O-W C	$8,906	$387

Take Home Points

- CT is a great diagnostic tool and can begin the staging process for malignancies
- Incidental findings should be assessed with patient history and presentation in mind.
- Annual Screening can help diagnose malignancies sooner on average
- When imaging patients, be thorough. Staging of tumors correctly can lead to curative surgical outcomes if no metastasis is detected.

Colorectal Cancer Screening

TABLE 2 Guidelines for Screening for the Early Detection of Colorectal Cancer and Adenomas for Average-risk Women and Men Aged 50 Years and Older

The following options are acceptable choices for colorectal cancer screening in average-risk adults beginning at age 50 years. Since each of the following tests has inherent characteristics related to prevention potential, accuracy, costs, and potential harms, individuals should have an opportunity to make an informed decision when choosing one of the following options.

In the opinion of the guidelines development committee, *colon cancer prevention* should be the primary goal of colorectal cancer screening. Tests that are designed to detect both early cancer and adenomatous polyps should be encouraged if resources are available and patients are willing to undergo an invasive test.

Tests that Detect Adenomatous Polyps and Cancer

Test	Interval	Key Issues for Informed Decisions
FSIG with insertion to 40 cm or to splenic flexure	Every 5 years	• Complete or partial bowel prep is required • Sedation usually is not used, so there may be some discomfort during the procedure • The protective effect of sigmoidoscopy is primarily limited to the portion of the colon examined • Patients should understand that positive findings on sigmoidoscopy usually result in a referral for colonoscopy
Colonoscopy	Every 10 years	• Complete bowel prep is required • Conscious sedation is used in most centers; patients will miss a day of work and will need a chaperone for transportation from the facility • Risks include perforation and bleeding, which are rare but potentially serious; most of the risk is associated with polypectomy
DCBE	Every 5 years	• Complete bowel prep is required • If patients have one or more polyps ≥6 mm, colonoscopy will be recommended; follow-up colonoscopy will require complete bowel prep • Risks of DCBE are low; rare cases of perforation have been reported
CTC	Every 5 years	• Complete bowel prep is required • If patients have one or more polyps ≥6 mm, colonoscopy will be recommended; if same day colonoscopy is not available, a second complete bowel prep will be required before colonoscopy • Risks of CTC are low; rare cases of perforation have been reported • Extracolonic abnormalities may be identified on CTC that could require further evaluation

Tests that Primarily Detect Cancer

Test	Interval	Key Issues for Informed Decisions
gFOBT with high sensitivity for cancer	Annual	• Depending on manufacturer's recommendations, 2 to 3 stool samples collected at home are needed to complete testing; a single sample of stool gathered during a digital exam in the clinical setting is not an acceptable stool test and should not be done
FIT with high sensitivity for cancer	Annual	• Positive tests are associated with an increased risk of colon cancer and advanced neoplasia; colonoscopy should be recommended if the test results are positive • If the test is negative, it should be repeated annually • Patients should understand that one-time testing is likely to be ineffective
sDNA with high sensitivity for cancer	Interval uncertain	• An adequate stool sample must be obtained and packaged with appropriate preservative agents for shipping to the laboratory • The unit cost of the currently available test is significantly higher than other forms of stool testing • If the test is positive, colonoscopy will be recommended • If the test is negative, the appropriate interval for a repeat test is uncertain

Abbreviations: FSIG, flexible sigmoidoscopy; DCBE, double-contrast barium enema; CTC, computed tomography colonography; gFOBT, guaiac-based fecal occult blood test; FIT, fecal immunochemical test; sDNA, stool DNA test.

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Questions?