



- 1) A 28-year-old man presents to the clinic complaining of occasional crampy abdominal pain and intermittent tarry stools associated with fatigue and light headedness. He is otherwise healthy with no prior surgical history. On exam, the patient has stable vitals. His abdominal exam is benign, and his Guaiac test demonstrates occult blood. His primary care physician has already performed basic laboratory tests which notably demonstrate a hemoglobin of 8.5. What diagnostic study should be performed next?
- Abdominal CT
 - Endoscopy**
 - Abdominal Ultrasound
 - Abdominal MRI

Obscure bleeding can be frustrating for both the patient and the clinician. However, up to 90% of lesions can be identified through EGD and colonoscopy¹. Therefore, endoscopy should be the primary choice of investigation. The diagnostic evaluation of patients with obscure GI bleeding should be tailored to the severity of bleeding and to the availability of technology and expertise.

- 2) The upper and lower endoscopy are unremarkable and do not identify the source of bleeding. You decide to obtain an ultrasound which demonstrates a peristaltic blind-ending pouch arising from the distal small bowel. This most likely represents a:
- Carcinoid tumor
 - Gastrointestinal stromal tumor
 - Duplication cyst
 - Meckel's diverticulum**

Given the history of occult bleeding with negative upper and lower endoscopy and the CT findings, this most likely represents a Meckel's diverticulum. A Meckel's diverticulum occurs due to failure of the omphalomesenteric (vitelline) duct to obliterate. It is one of the most prevalent congenital anomalies of the GI tract.

A Meckel's diverticulum is a true diverticulum because the bowel wall contains all of the layers found in normal small intestine. Approximately 60% of Meckel's diverticula contain heterotopic mucosa, of which over 60% consist of gastric mucosa². Meckel's diverticulum is usually asymptomatic in the majority of cases with the incidence of complication ranging from 4-6%.

- 3) Which of the following does NOT describe presentation of Meckel's diverticulum?
- Has an overall 2% prevalence
 - Has a 2:1 male predominance
 - Is usually located 2 feet (100cm) proximal to the ileocecal valve in adults
 - 2% present with perforation**

A useful, although crude, mnemonic describing Meckel's diverticulum is the "rule of two's": 2% prevalence, 2:1 male predominance, location within 2 feet proximal to the ileocecal valve in adults, and half of those who are symptomatic are under 2 years of age. For those presenting with symptoms



suggestive of a Meckel's diverticulum, confirmatory imaging can be challenging. The sensitivity of CT scanning for the detection of Meckel's diverticula is too low to be clinically useful. Enteroclysis is associated with an accuracy of 75% and is the most acceptable accurate investigation currently. Radionuclide scans (^{99m}Tc -pertechnetate) can be helpful in the diagnosis of Meckel's diverticulum (provided the diverticulum has heterotopic gastric tissue).

- 4) You decide to explore this patient laparoscopically. You begin to run the bowel from the ileocecal valve retrograde. You find a wide-based Meckel's diverticulum with an adjacent ulcer in the distal ileum. Which of the following options is the best choice of treatment?
- Diverticulectomy with primary closure
 - Diverticulectomy with wedge resection of involved bowel
 - Resection of the involved small bowel with primary anastomosis
 - Segmental small bowel resection with end ileostomy

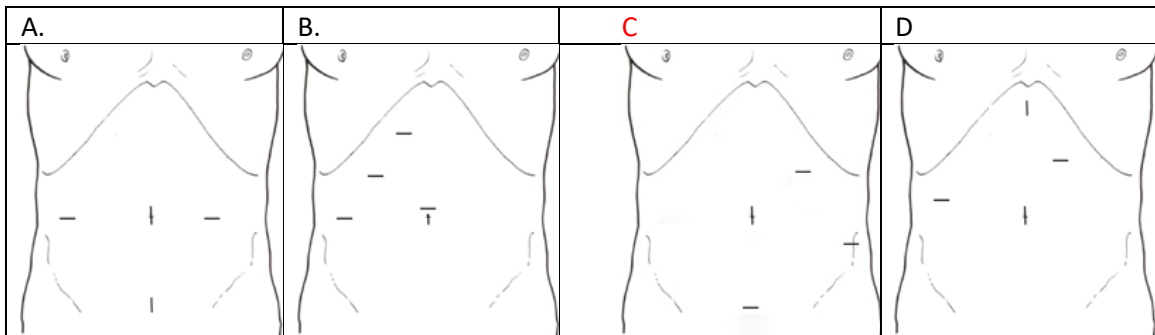
The surgical treatment of a bleeding Meckel's diverticulum consists of a segmental resection of ileum that includes both the diverticulum and the adjacent ileal ulcer. Ulceration typically occurs because the diverticulum may contain ectopic gastric tissue which upon secretion causes mucosal ulceration of adjacent small bowel tissue.

- 5) Which of the following would have the LEAST impact on your ability to pursue this diagnosis laparoscopically?
- Platelet count of 25,000
 - Known chronic liver disease
 - BMI > 35
 - Perforated diverticulum with generalized peritonitis
- 6) You proceed with laparoscopic surgery and place the patient under general anesthesia. You perform needle insufflation and place a trocar at the umbilicus. The anesthesiologist informs you that the patient's blood pressure has acutely dropped. His blood pressure is 50/palpable, pulse is 90. The anesthesiologist auscultates a "mill wheel" murmur over the pericardium. What do you do next?
- Immediate resuscitation with isotonic fluid fluids (20ml/kg) and proceed with the laparoscopic procedure if stability achieved
 - Abort laparoscopy and perform immediate exploratory laparotomy to check for hemorrhage
 - Instruct the anesthesiologist to administer IV epinephrine, diphenhydramine, and steroids
 - Discontinue insufflation, abort the procedure, and place the patient in left lateral decubitus position with the head down followed by insertion of central venous catheter



Gas emboli are rare but serious complications of laparoscopic surgery which should be suspected if hypotension develops during insufflation. Diagnosis may be made by auscultating (with an esophageal stethoscope) for the characteristic “mill wheel” murmur. The treatment of gas embolism is to place the patient in a left lateral decubitus position with the head down to trap the gas in the apex of the right ventricle. A rapidly placed central venous catheter then can be used to aspirate the gas out of the right ventricle.

- 7) Which of the following trocar placements is best suited for your laparoscopic small bowel resection?



There is no single correct answer for this. However, your chosen port configuration must allow for triangulation of the distal small bowel in the right lower quadrant. This would best be achieved through Answer C.

- 8) You have identified the Meckel's diverticulum and elect to proceed with small bowel resection. Which of the following may NEGATIVELY impact the creation of a successful primary anastomosis?
- The mesentery around the anastomosis is not under tension
 - Patient has received 6 L of saline
 - Bleeding from the freshly cut bowel edges
 - No obvious gross spillage of bowel contents

Accurate approximation of two well-vascularized, healthy limbs of bowel without tension in a normotensive, well-nourished patient is the best situation for a successful anastomosis. Anastomoses at highest risk of leak or stricture are those located in the distal rectal or anal canal, involve irradiated or diseased intestine including perforation with peritoneal soilage, or are performed in malnourished, immunosuppressed, or ill patients. Overzealous fluid administration during bowel anastomosis is also associated with higher leakage rate due to bowel wall edema^{3,4}.

- 9) The patient is now on post-operative day 1 and is complaining of bilateral shoulder pain. His vitals and abdominal exam are reassuring. How would you proceed?



- a. Explain to the patient that the pain is most likely from neuropraxia resulting from prolonged arm abduction which will resolve in 2-3 days.
- b. Give patient aspirin 325 mg and conduct workup for acute myocardial infarction
- c. Start IV antibiotics and conduct workup for pneumonia
- d. Reassure the patient that the pain is most likely from due to the irritation of the phrenic nerve and will resolve within 2-3 days

References:

1. Schwartz's Principles of Surgery. 10th edition. Chapter 28: Small Intestine. Ali Travakkoli; Stanley W. Ashley; Michael J. Zinner. Page 1167.
2. Schwartz's Principles of Surgery. 10th edition. Chapter 28: Small Intestine. Ali Travakkoli; Stanley W. Ashley; Michael J. Zinner. Page 1163.
3. Schwartz's Principles of Surgery. 10th edition. Chapter 9: Wound Healing. Adrian Barbul; David T. Efron; Sandra L. Kavalukas. Page 249.
4. Schwartz's Principles of Surgery. 10th edition. Chapter 29: Colon, Rectum, Anus. Kelli M. Bullard Dunn; David A. Rothenberger. Page 1189.