70-Year-Old Man With Chronic Nausea and Vomiting

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A 70-year-old man with a medical history notable for gastroesophageal reflux disease, achalasia (status post Nissen fundoplication take down and hiatal hernia repair with later takedown and Heller myotomy with Dor fundoplication), chronic obstructive pulmonary disease, heart failure with preserved ejection fraction, chronic back pain, osteoarthritis, opioid use, insulin-dependent diabetes, diabetic neuropathy, and a diagnosis of gastroparesis presented with symptoms of altered mental status in the setting of intractable nausea and vomiting. He reported bilious vomiting, inability to tolerate oral intake, and epigastric abdominal pain. His nausea and vomiting had been ongoing for several weeks. The patient had recently been discharged from the hospital 3 days previously for similar symptoms. A computed tomography (CT) scan of the abdomen obtained during the previous admission revealed wall thickening in the distal esophagus thought to be related to an inflammatory or infectious etiology. Additionally, his stomach appeared dilated with residual food content. During that admission, general surgery was consulted. At that time, an esophagram revealed prompt passage through previous myotomy/fundoplication and the reflux of gastric contents into the esophagus. A small bowel follow-through did not reveal any evidence of obstruction and contrast was seen reaching the colon in 4 hours. Given his symptoms and the presence of food in his stomach, he was treated for gastroparesis thought secondary to poorly controlled diabetes and chronic opioid use. He was discharged with plans to follow up in the gastrointestinal motility clinic and instructed to discontinue opioids.

The patient was examined in the emergency department. Vital signs revealed that he was afebrile, with a heart rate of 100 beats/min and a regular rhythm, a blood pressure of 144/95 mm Hg, and an oxygen saturation of 98% on room air. His body mass index was 26.4 kg/m². He was disoriented, confused, and restless. However, his speech was clear. He had 5/5 strength in both upper and lower extremities. Asterixis was not present. Extraocular movements were intact. His abdomen was not distended; bowel sounds were present, although he was diffusely tender without guarding or rebound. His cardiac and pulmonary examinations were unremarkable. He had increased skin turgor.

Laboratory studies yielded the following (reference ranges provided parenthetically): hemoglobin level, 12.2 g/dL (13.5 to 17.5 g/dL); white blood cell count, 7.4×10⁹/L ((3.4 to 9.6)×10⁹/L); platelet count, 238×10⁹/L ((135 to 317)×10⁹/L); sodium level, 137 mmol/L (135 to 145 mmol/L); potassium level, 4.0 mmol/L (3.6 to 5.2 mmol/L); creatinine level, 0.92 mg/dL (0.74 to 1.35 mg/dL); bicarbonate level, 22 mmol/L (3.6 to 5.2 mmol/L); sodium level, 137 mmol/L (135 to 145 mmol/L); potassium level, 4.0 mmol/L (3.6 to 5.2 mmol/L); creatinine level, 0.92 mg/dL (0.74 to 1.35 mg/dL); bicarbonate level, 22 mmol/L (22 to 29 mmol/L); glucose level, 131 mg/dL (70 to 100 mg/dL); blood urea nitrogen level, 13 mg/dL; β-hydroxybutyrate level, 0.2 mmol/L (<0.4 mmol/L); albumin level, 3.4 g/dL (3.5 to 5.0 g/dL); and lipase level, 14 U/L (13 to 60 U/L).

A urine drug screen was positive for benzodiazepines and oxycodone. His ethanol level was negative. An electrocardiogram was notable for the prolonged corrected QT interval at 472 ms. His urinalysis was unremarkable. A CT scan of the head revealed no evidence of intracranial pathology, and his chest radiograph was normal. An abdominal radiograph exhibited a nonobstructive bowel gas pattern.
1. Given his initial presentation and his persistent symptoms, which one of the following is the most likely cause of his chronic nausea and vomiting?
   a. Mucosal inflammation
   b. Motility disorder
   c. Mechanical obstruction
   d. Functional gastroduodenal disorder
   e. Cannabinoid hyperemesis syndrome

   Mucosal inflammation encompasses disorders including Crohn disease, pancreatitis, cholecystitis, hepatitis, and appendicitis. The patient’s lipase and liver levels were unremarkable, and his physical examination was not consistent with appendiceal or gallbladder pain. Although initially diagnosed with gastroparesis, the apparent dilation of the stomach on CT imaging raised the possibility of a possible obstructive process. Motility disorders require that mechanical obstruction first be ruled out. Functional gastroduodenal disorders include cyclic vomiting and rumination syndrome. Both disorders are more common in children and adolescents and would be unusual to develop in the seventh decade of life. Cannabinoid hyperemesis syndrome may develop in patients who use marijuana (any form) chronically. The patient did not use marijuana or other cannabinoid products, and his urine drug screen was negative for tetrohydrocannabinol.

   The gastroenterology consult service evaluated the patient and arranged esophagogastroduodenoscopy, which revealed an apparent extrinsic stenosis in the second portion of the duodenum. The duodenal mucosa appeared normal. Upper gastrointestinal (UGI) series displayed a short segment of narrowing in the descending duodenum with normal mucosa and peristalsis.

   A large bowel obstruction can present with findings of anorexia with nausea and vomiting. Bowel sounds are typically tympanic, and an abdominal radiograph should reveal an obstructive bowel gas pattern. However, this patient did not have any risk factors for a large bowel obstruction and his abdominal radiograph did not reveal a dilated colon, making this diagnosis unlikely. Pyloric stenosis is a congenital disorder characterized by hypertrophied muscle near the pyloric sphincter. It is typically diagnosed in infancy with a history of projectile nonbilious vomiting. Acute pancreatitis can present with nausea, vomiting, and abdominal pain. The 2 most common etiologies include gallstones and alcohol consumption. Patients typically have epigastric pain and elevated pancreatic enzymes (lipase and/or amylase) along with characteristic findings on imaging. A duodenal stenosis is an incomplete obstruction of the lumen of the duodenum. Typically, it is seen in infants with a scaphoid abdomen and a distended upper abdomen. Gastric volvulus is an abnormal rotation of the stomach. It can present as “Borchardt triad,” which involves nonproductive vomiting, severe epigastric pain, and difficulty with insertion of a nasogastric tube.

   Given the results of UGI series suggesting duodenal stenosis, he was diagnosed with gastric outlet obstruction. UGI series did not find dilation of the proximal duodenum. At this point, it was uncertain whether it was benign or malignant. An extrinsic lesion could not be ruled out.

2. Which one of the following is the next best step to further classify this area of stenosis?
   a. Abdominal magnetic resonance cholangiopancreatography (MRCP) (secretin-enhanced)
   b. Saline load test
   c. Computed tomography scan of the abdomen and pelvis
   d. Gastric emptying study
   e. Antroduodenal manometry

   Magnetic resonance cholangiopancreatography uses magnetic fields to construct
3-dimensional images of the abdomen, particularly the biliary tree and pancreatic ducts. A secretin-enhanced protocol enables better visualization of the pancreatic duct. Secretin leads to an increase in pancreatic fluid secretion, which increases the caliber of the pancreatic duct (thereby permitting better visualization). This protocol also provides an increased radiographic signal. The saline load test was commonly performed in the past to identify gastric outlet obstruction; however, it is rarely used at present, as it is neither a sensitive nor a specific test. During this procedure, 750 mL of sodium chloride is infused into the stomach via a nasogastric tube. After 30 minutes, if more than 400 mL remains, gastric outlet obstruction is identified. A CT scan of the abdomen and pelvis provides greater visualization of blood vessels and various structures within the abdominal region. However, the test had just been performed and a second scan would be unlikely to provide additional information. A nuclear gastric emptying study (gastric scintigraphy) measures the amount of radiolabeled isotope that remains in the stomach at different time points after ingestion. It provides an objective measure of gastric emptying.

Manometry measures tone, pressure, relaxation, and contractile activity in the luminal gastrointestinal tract and can be used to evaluate esophageal disorders such as achalasia. Antroduodenal manometry focuses on the distal stomach and duodenum but would not provide further information as to the cause of obstruction. In this patient, magnetic resonance abdomen/magnetic resonance cholangiopancreatography without intravenous contrast was performed and revealed annular pancreas with annular ducts joining the main duct at the level of the major papilla.

4. Which one of the following most accurately describes the type of gastric outlet obstruction this patient is suffering from?
   a. Malignant
   b. Iatrogenic
   c. Congenital
   d. Inflammatory
   e. Infiltrative

Malignant causes of obstruction include gastric, duodenal, pancreatic, or metastatic cancer. Iatrogenic causes of obstruction include percutaneous endoscopic gastrostomy tube migration and postsurgical complications. Annular pancreas is a congenital malformation in which the embryonic ventral bud of the pancreas does not properly rotate during early gestation. This leads to either an incomplete or a complete ring of tissue that encircles the second part of the duodenum. Most patients are asymptomatic. However, it has the potential to lead to obstruction and pancreatitis. In the past, inflammatory causes, such as peptic ulcer disease, were the most common cause of gastric outlet obstruction, although that is now much less common. Infiltrative causes include Crohn disease, gastric tuberculosis, lymphoma, sarcoïd, amyloid, as well as other conditions such as eosinophilia. The pancreatic tissue twisting around the duodenum on imaging was pathognomonic for annular pancreas, a congenital condition.

5. Which one of the following is the definitive treatment for this patient’s gastric outlet obstruction?
   a. Dietary modifications
   b. Surgical bypass
   c. Trial of a prokinetic agent
   d. Surgical resection and primary anastomosis
   e. Endoscopic dilation

Dietary modification is a common treatment strategy for gastrointestinal motility disorders including gastroparesis, irritable bowel syndrome, and celiac disease. Eating smaller meals or going on a liquid diet might alleviate some symptoms of gastroparesis; however, this would not be a long-term solution for most patients. Because the duodenum is a fixed structure, bypass surgery is warranted. This includes duodenojunostomy or gastrojejunostomy. Prokinetic agents, such as metoclopramide or domperidone, are first-line medications used for the
treatment of symptoms of gastroparesis. However, these medications are contraindicated in the setting of mechanical obstruction. Surgical resection is controversial given the proximity to vital organs. Endoscopic dilation is associated with a higher risk of pancreatitis. The patient’s case was discussed at the pancreas tumor board with a final recommendation to pursue gastrojejunostomy bypass surgery instead of a Whipple procedure.

DISCUSSION
Although our patient was previously diagnosed with gastroparesis on the basis of his symptoms and comorbid condition, the final diagnosis as the main culprit for his persistent symptoms was that of gastric outlet obstruction. Disorders of chronic nausea and vomiting should have a framework approach. The differential diagnoses can be divided into distinct categories including mechanical obstruction, mucosal inflammation, motility disorders, and functional gastroduodenal disorders. Gastroparesis is defined by delayed gastric emptying, in the absence of obstruction, with associated symptoms of nausea, vomiting, early satiety, fullness, bloating, and abdominal pain. This is measured by a scintigraphic radionucleotide gastric emptying test that can measure the amount of an ingested radiolabeled isotope over 4 hours. However, the interpretation of these studies is controversial as many institutions do not perform the test properly. Medications that affect gastric emptying (ie, opioids, prokinetic agents, calcium channel blockers, and tricyclic antidepressants) should be held at least 48 hours before the test, and in diabetic patients, blood glucose levels should be less than 180 mg/dL to avoid false-positive/negative results. In the patient’s previous hospitalization, his small bowel follow-through was reported as normal, although his esophagram did mention a dilated gastric filled lumen. It was unclear whether he was diagnosed with gastroparesis previously on the basis of the results of a gastric emptying study.

The most common causes of gastroparesis are diabetes, medications (particularly opioids), and previous gastric surgery (eg, Nissen fundoplication). Our patient had all 3 of these risk factors. Diabetic neuropathy affects nerve conduction in the intestinal cells of Cajal, which function as pacemaker cells in the digestive system. Opioid medications slow down gastrointestinal transit through opioid receptors in the bowel. If the etiology is unclear, laboratory studies including C-reactive protein, thyroid stimulating hormone, SCL-70, and antinuclear body titers can be used to help identify an underlying autoimmune etiology. The patient’s endocrinologist had been working with him in the outpatient setting to control his diabetes; however, his blood glucose levels were difficult to control as his recurrent nausea and vomiting placed him at risk for hypoglycemia. The patient had also been working with the pain management service in an attempt to taper him off his high-dose opioids and benzodiazepines.

Nonetheless, our patient’s symptoms did not improve. As noted, the diagnosis of gastroparesis can only be made after structural/mechanical causes of nausea, vomiting, and abdominal pain have been considered. This is generally done with upper endoscopy or UGI series. However, the diagnostic accuracy and interoperability of these series are controversial. Typically, these mechanical obstructions can be divided into broad categories including gastric or small bowel obstruction, superior mesenteric artery syndrome, volvulus, and antral web. Annular pancreas masquerading as a gastric outlet obstruction is uncommon. Annular pancreas is more likely to develop in infancy, and when it does, it causes meconium ileus.

The American Society for Gastrointestinal Endoscopy categorizes gastric outlet obstruction treatments depending on whether the obstruction is benign or malignant. Treatment includes advanced endoscopy or surgery. Benign mechanical obstruction endoscopic management includes balloon dilation or self-expandable metal stent placement. Self-expandable metal stents are metal alloys that expand after being deployed in the lumen, thereby allowing liquids and solid foods to pass
through the obstructed region. Balloon dilation is a reasonable solution if a discrete area of narrowing is identified and the balloon can be passed through the stricture. Narrow strictures may require repeated balloon dilation sessions performed every 5 to 7 days, depending on symptom improvement, with up to 70% to 80% of patients achieving clinical response. Surgery is indicated if the obstruction persists/recurs in spite of medical and endoscopic management. It is generally considered the last resort for benign mechanical obstruction.

Treatment options for malignant mechanical obstruction are similar. Self-expandable metal stent placement suggests a high clinical success rate of 89% overall, with 48% of patients being able to resume a full diet within 4 days. Additionally, self-expandable metal stent placement can be an alternative to palliative surgery. However, complications such as perforation, stent migration, bleeding, and sepsis can be seen in up to 1% of cases. Percutaneous endoscopic or radiologic decompressive gastrostomy with jejunal extension or a concurrent PEJ tube could help to alleviate abdominal pressure and allow access for nutrition. It is relatively contraindicated if ascites is present and complications such as infections have been noted in the literature. Surgery is preferred for patients with potential for curative resection. Surgical approaches include duodenoduodenostomy, gastrojejunostomy, or a Whipple procedure. In a case report, 2 patients had complete resolution of symptoms with laparoscopic gastrojejunostomy. Given the risks of pancreatitis with dilation, our patient was recommended to pursue gastrojejunostomy.

In summary, we present a case of a 70-year-old gentleman with diabetes who presented with intractable nausea and vomiting who was initially thought to have gastroparesis. An evaluation identified gastric outlet obstruction secondary to annular pancreas. His care highlights the importance of imaging and structural evaluation in the evaluation of a patient with suspected gastroparesis.

**Potential Competing Interests:** The authors report no competing interests.

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**REFERENCES**


**CORRECT ANSWERS:** 1. c. 2. d. 3. a. 4. c. 5. b.