32-Year-Old-Woman With Abdominal Pain

Kayin B. Jeffers, MD; Donnesha B. Clayton, MD; and Michele D. Lewis, MD

A 32-year-old woman presented to the emergency department with a 2-day history of abdominal pain. She described the pain as a sharp sensation in the epigastric region with radiation to the back. The pain was accompanied by 3 episodes of nonbloody emesis. She had been examined 1 day previously at a local urgent care facility and was given a prescription for a gastrointestinal medication that provided minimal relief. She did not have fever, chills, chest pain, dyspnea, hematemesis, hematochezia, melena, or dysuria. Her medical history was notable for anxiety, and her social history was remarkable for one glass of red wine daily with dinner. She did not use tobacco or illicit drugs. Her only medication was alprazolam.

On physical examination, the patient was in moderate distress. Her temperature was 37.4°C, blood pressure was 149/93 mm Hg, pulse rate was 93 beats/min, and respiratory rate was 18 breaths/min. Her sclerae were anicteric. Cardiopulmonary examination findings were normal, and her abdomen was soft and nondistended. She had normal active bowel sounds and tenderness on palpation of the epigastrium without rebound tenderness. No ecchymosis was evident around her umbilicus or flanks bilaterally. Laboratory values on admission included the following (reference ranges provided parenthetically): hemoglobin, 16.0 g/dL (13.5-17.5 g/dL); hematocrit, 50% (38.8%-50.0%); white blood cell count, 10.8 × 10^9/L (3.5-10.5 × 10^9/L); platelet count, 316 × 10^9/L (150-450 × 10^9/L); alanine aminotransferase (ALT), 601 U/L (7-55 U/L); sodium, 141 mmol/L (135-145 mmol/L); potassium, 3.7 mmol/L (3.6-4.8 mmol/L); serum urea nitrogen (BUN), 10 mg/dL (8-24 mg/dL); creatinine, 0.8 mg/dL (0.9-1.4 mg/dL); aspartate aminotransferase (AST), 409 U/L (8-48 U/L); albumin, 3.9 g/dL (3.5-5.0 g/dL); total bilirubin, 6.2 mg/dL (0.1-1.2 mg/dL); direct bilirubin, 3.3 mg/dL (0.1-0.4 mg/dL); alkaline phosphatase, 126 U/L (45-115 U/L); and lipase, 9360 U/L (7-60 U/L). Electrocardiography revealed normal sinus rhythm. No focal consolidations or pleural effusions were noted on chest radiography.

1. Which *one* of the following is the *most appropriate* step in establishing the diagnosis of acute pancreatitis?

a. No further diagnostic studies are indicated
b. Serum amylase measurement
c. Serum triglyceride measurement
d. Computed tomography (CT) of the abdomen
e. Abdominal ultrasonography

The diagnosis of acute pancreatitis can be established if at least 2 of the following 3 criteria are met: abdominal imaging with characteristic findings suggestive of acute pancreatitis, lipase or amylase level greater than 3 times the upper limit of normal, and abdominal pain characteristic of the disease (epigastric pain, commonly radiating to the back).[1] There is no need for further diagnostic modalities because the patient has met 2 of the 3 criteria needed to establish a diagnosis of acute pancreatitis. There is no need to measure the amylase level if the lipase level is elevated to more than 3 times the upper limit of normal. Serum triglyceride measurement can be important in identifying the etiology of pancreatitis; however, it has no utility in diagnosing pancreatitis. Computed tomography of the abdomen should be reserved for patients in whom the diagnosis of acute pancreatitis is uncertain.[1] Abdominal ultrasonography is indicated to evaluate for gallstones as a cause of acute pancreatitis; however, it is not required to establish the diagnosis of acute pancreatitis.

On admission to the hospital, morphine and ondansetron were administered every 4 hours as needed for pain and nausea. The patient was instructed to avoid oral intake as long as she continued to have emesis. Lactated Ringer solution was administered at a rate of 250 mL/h. Serum calcium and triglyceride levels were measured to evaluate the etiology

See end of article for correct answers to questions.

Resident in Internal Medicine, Mayo School of Graduate Medical Education, Jacksonville, FL (K.B.J., D.B.C.); Advisor to Residents and Consultant in Gastroenterology and Hepatology, Mayo Clinic, Jacksonville, FL (M.D.L.).

of the episode of acute pancreatitis, and the values were 8.4 mg/dL (8.9-10.5 mg/dL) and 150 mg/dL (<200 mg/dL), respectively.

2. Which *one* of the following is the *most likely* cause of acute pancreatitis in this patient?

a. Excessive alcohol consumption
b. Hypertriglyceridemia
c. Gallstones
d. Pancreaticobiliary tumor
e. Drugs

The patient did not report excessive alcohol use (she consumes one glass of wine at dinner), so it is an unlikely cause of her acute pancreatitis. Hypertriglyceridemia has been established as a cause of acute pancreatitis in approximately 1% to 4% of all cases; however, the patient's serum triglyceride level was normal on admission, making hypertriglyceridemia a less likely cause of acute pancreatitis in this patient. The most common causes of acute pancreatitis are gallstones and alcohol-induced pancreatitis. This patient's liver enzymes (especially ALT) and bilirubin level are elevated, which may suggest choledocholithiasis. An ALT level of 150 IU/L or greater has a 95% positive predictive value for acute gallstone pancreatitis; considering that this patient's ALT was 601 IU/L on admission, the diagnosis of gallstone pancreatitis is most likely.[2] Patients older than 40 years of age should be evaluated for pancreaticobiliary cancer as a potential cause of acute pancreatitis if alcohol-induced or gallstone etiologies are ruled out. The patient's only medication is alprazolam, a medication that has no association with acute pancreatitis.

3. Which *one* of the following values, when monitored over the first 24 hours of admission, is *most predictive* of mortality?

a. BUN
b. Hematocrit
c. Heart rate
d. Age greater than 55 years
e. Lipase

Studies have revealed that an elevated BUN level at admission or 24 hours later is associated with a higher predictive value for mortality.[3] Elevated hematocrit concentration, heart rate, and age greater than 55 years are associated with a more severe course of acute pancreatitis, and these variables can be used for initial risk assessment.[1] Although lipase is considered when making the diagnosis of pancreatitis, it has no predictive value for mortality.

Within 6 hours of admission to the hospital, the patient's pain began to improve somewhat with morphine, and her nausea began to subside. Her BUN level remained at 10 mg/dL. She underwent abdominal ultrasonography, which revealed cholelithiasis and dilation of the common bile duct.

On the second day of hospitalization, the patient's vital signs included a temperature of 36.8°C, pulse rate of 85 beats/min, and blood pressure of 101/62 mm Hg. Laboratory studies revealed the following values: hematocrit, 43.3%; creatinine, 0.7 mg/dL; BUN, 8 mg/dL; total bilirubin, 6.8 mg/dL; direct bilirubin, 3.0 mg/dL; alkaline phosphatase, 140 U/L; ALT, 600 U/L; and AST, 390 U/L.

4. Which *one* of the following is the *most appropriate* next therapeutic step for this patient?

a. CT of the abdomen and pelvis
b. Endoscopic retrograde cholangiopancreatography (ERCP) followed by cholecystectomy
c. ERCP and cholecystectomy in 6 weeks
d. Increase intravenous fluid rate
e. Discharge home

There is no reason for CT of the abdomen and pelvis in this patient; however, patients who do not improve clinically within 72 hours or have an unclear diagnosis require CT or magnetic resonance imaging (MRI) of the abdomen to evaluate for complications of acute pancreatitis[1] and, in idiopathic cases, further etiologic work-up for entities such as malignant tumors or mucinous cystic neoplasms. In patients with gallstone pancreatitis whose liver function test results are persistently elevated, especially a bilirubin level greater than 4 mg/dL, ERCP should be performed because such findings indicate that the stone is still present in the common bile duct. The ERCP should be performed during the initial hospitalization to prevent complications.[4] If ERCP reveals a stone, the patient

Mayo Clin Proc. ■ April 2017;92(4):e63-e67 ■ http://dx.doi.org/10.1016/j.mayocp.2016.06.033
www.mayoclinicproceedings.org

should undergo cholecystectomy. There is no role for ERCP 6 weeks after an episode of acute pancreatitis. Similarly, there is no role for increasing the rate of intravenous fluids in the absence of increasing BUN and creatinine levels because it can lead to unnecessary complications including peripheral and pulmonary edema. The patient continues to have pain and requires cholecystectomy, so she has not met criteria for discharge at this time.

The gastroenterology service was consulted, and shortly thereafter, the decision was made to perform ERCP. The study revealed a mildly dilated biliary tree with choledocholithiasis. Endoscopic sphincterotomy was performed, and gallstones were removed from the common bile duct. The patient's nausea resolved, and her abdominal pain improved considerably.

She was ambulating well with physical therapy. The following day, laboratory studies revealed the following: hematocrit, 38%; BUN, 5 mg/dL; creatinine, 0.6 mg/dL; alkaline phosphatase, 109 U/L; ALT, 358 U/L; AST, 126 U/L; total bilirubin, 2.1 (6.2 mg/dL on admission); and direct bilirubin, 0.6 mg/dL.

5. At this time, which *one* of the following types of diet should be initiated?

a. Nothing by mouth until resolution of abdominal pain
b. Clear liquid diet
c. Low-fat solid diet
d. Tube feedings delivered through a nasoenteric tube
e. Total parenteral nutrition

Initiation of feeding within 72 hours of hospitalization in patients with acute pancreatitis is needed to prevent intestinal atrophy, decrease risk of infectious complications, and decrease hospital stay.[5] There is no need to wait for the resolution of abdominal pain before advancing a patient's diet from nothing by mouth; if the patient is hungry and able to tolerate food, feeding should be initiated. Studies have proven that initiation of a low-fat solid diet is as safe as implementing a clear liquid diet. A low-fat solid diet has been reported to increase the caloric intake and shorten the hospital stay in patients with mild acute pancreatitis.[1-6] If a patient is unable to tolerate oral intake, a nasoenteric tube can be placed for caloric requirements, but there is no role for total parenteral nutrition unless the patient cannot tolerate other measures.

Initiatation of a low-fat solid diet was well tolerated. General surgery was consulted, and cholecystectomy was performed laparoscopically. The patient's abdominal pain resolved, and she was discharged home with instructions to follow up with her primary care physician.

DISCUSSION

The single most frequent gastrointestinal cause of hospital admissions in the United States in 2009 was acute pancreatitis, with approximately 275,000 hospitalizations.[7] Symptoms characteristic of acute pancreatitis are nausea, vomiting, and epigastric pain with radiation to the back. The diagnosis is established by the presence of 2 of the following 3 criteria: (1) abdominal pain consistent with the disease, (2) serum lipase and/or amylase levels greater than 3 times the upper limit of normal, and (3) characteristic abdominal imaging findings on CT and/or MRI.[1]

The most common etiology of acute pancreatitis is gallstones. Other etiologies include excessive alcohol use, hypertriglyceridemia, hypercalcemia, trauma, drugs, and neoplastic processes. Laboratory work-up should include measurement of lipase/amylase, calcium, and triglyceride levels and liver function tests. If autoimmune disease is suspected, the IgG4 serum level should be determined.[8] Imaging should always include abdominal ultrasonography to evaluate for cholelithiasis.[8] Computed tomography, MRI, or endoscopic ultrasonography can be used to evaluate for malignant neoplasms and microlithiasis in patients with concerning features (eg, age >40 years, weight loss, new-onset diabetes), followed by ERCP if these tests reveal abnormalities.[8]

There are 2 types of acute pancreatitis: interstitial edematous and necrotizing pancreatitis. Interstitial edematous pancreatitis is characterized by homogeneous enhancement of the pancreatic parenchyma. Necrotizing pancreatitis develops from impaired perfusion and is characterized by a nonenhancing area of pancreatic parenchyma on CT. Necrotic pancreatic tissue can also become infected.

This diagnosis can be established by evidence of extraluminal gas in pancreatic or peripancreatic tissue on CT and by percutaneous image-guided fine-needle aspiration biopsy with specimens positive for bacteria/fungi on Gram stain or culture.[9]

Acute pancreatitis is also classified by severity. Mild acute pancreatitis is characterized by the absence of organ failure or local complications. In moderate severe acute pancreatitis, local complications and/or organ failure present transiently (<48 hours). In severe acute pancreatitis, organ failure is persistent, lasting more than 48 hours. Organ failure is assessed by the Modified Marsh Classification, which evaluates the function of 3 organ systems (pulmonary, renal, and cardiovascular). In this system, organ failure is defined as any of the following: PaO_2 to fraction of inspired oxygen ratio of less than 301 mm Hg, serum creatinine level greater than 1.9 mg/dL, or systolic blood pressure less than 90 mm Hg that is unresponsive to fluid. Local complications include acute peripancreatic fluid collection, pancreatic pseudocyst, acute necrotic collection, and walled-off necrosis.[9] Local complications should be suspected when there is persistence or recurrence of abdominal pain, secondary increases in serum pancreatic enzyme activity, or increasing organ dysfunction. Complications should be evaluated with imaging such as CT or MRI.[8,9]

Initial management should be focused on fluid resuscitation. Patients should be aggressively hydrated with isotonic crystalloid solution at a rate of 250 to 500 mL/h for the first 12 to 24 hours.[10] Lactated Ringer solution is preferred because it has been found to decrease systemic inflammatory response syndrome. Early aggressive fluid resuscitation has been reported to decrease organ failure at 72 hours, length of hospital stay, and rate of ICU admissions.[11] The aim of aggressive fluid resuscitation is to reduce BUN or hematocrit levels within the first 24 hours of hospitalization; decreases in these variables are associated with a lower risk of mortality. If the patient's acute pancreatitis is secondary to gallstones, the patient should be assessed for choledocholithiasis with ultrasonography of the abdomen. Stones in the common bile duct usually pass spontaneously; however, if there is persistence in elevation of the bilirubin level, these patients should undergo ERCP. This procedure is indicated in acute pancreatitis if patients have both acute pancreatitis and acute cholangitis and have persistently elevated bilirubin levels.[1,4] Cholecystectomy is indicated during the initial hospitalization in patients with mild pancreatitis to prevent recurrent episodes of acute pancreatitis and complications. If a patient has severe pancreatitis or comorbidities that place them at a higher risk for surgical intervention, cholecystectomy can be considered at a later date.[1,12]

Early enteral feeding is associated with improved outcomes because it prevents intestinal mucosal atrophy and bacterial translocation.[5] In severe pancreatitis, enteral feeding should be initiated within the first 72 hours after nausea and vomiting have subsided and pain is controlled. However, if enteral feedings cannot be tolerated or cannot meet minimal nutritional requirements, parenteral feeding is suggested. Both nasogastric and nasojejunal tubes have been proven to be safe and effective as routes for enteral nutrition.[1,5] Antibiotics should be used for infected pancreatic necrosis or suspicion of bacterial ascending cholangitis but generally are not indicated in most patients during the first week of pancreatitis.

Correspondence: Address to Michele D. Lewis, MD, Division of Gastroenterology and Hepatology, Mayo Clinic, 4500 San Pablo Rd S, Jacksonville, FL 32224 (Lewis.michele@mayo.edu).

REFERENCES

1. Tenner S, Baillie J, DeWitt J, Vege SS. American College of Gastroenterology guideline: management of acute pancreatitis [published correction appears in *Am J Gastroenterol*. 2014;109(2):302]. *Am J Gastroenterol*. 2013;108(9):1400-1415; 1416.
2. Tenner S, Dubner H, Steinberg W. Predicting gallstone pancreatitis with laboratory parameters: a meta-analysis. *Am J Gastroenterol*. 1994;89(10):1863-1866.
3. Wu B, Johannes RS, Sun X, Conwell DL, Banks PA. Early changes in blood urea nitrogen predict mortality in acute pancreatitis. *Gastroenterology*. 2009;137(1):129-135.
4. Moretti A, Papi C, Aratari A, et al. Is early endoscopic retrograde cholangiopancreatography useful in the management of acute biliary pancreatitis? a meta-analysis of randomized controlled trials. *Dig Liver Dis*. 2008;40(5):379-385.
5. Janisch N, Gardner T. Recent Advances in Managing Acute Pancreatitis. *F1000Res*. 2015;4:1474. http://dx.doi.org/10.12688/f1000research.7172.1.
6. Bakker OJ, van Brunschot S, van Santvoort HC, et al; Dutch Pancreatitis Study Group. Early versus on-demand nasoenteric tube feeding in acute pancreatitis. *N Engl J Med*. 2014;371(21):1983-1993.

Mayo Clin Proc. ■ April 2017;92(4):e63-e67 ■ http://dx.doi.org/10.1016/j.mayocp.2016.06.033
www.mayoclinicproceedings.org

7. Peery AF, Dellon ES, Lund J, et al. Burden of gastrointestinal disease in the United States: 2012 update. *Gastroenterology*. 2012;143(5):1179:1187e1-1187e3.
8. Forsmark CE, Baillie J. AGA Institute technical review on acute pancreatitis. *Gastroenterology*. 2007;132(5):2022-2044.
9. Banks PA, Bollen TL, Dervenis C, et al; Acute Pancreatitis Classification Working Group. Classification of acute pancreatitis—2012: revision of the Atlanta classification and definitions by international consensus. *Gut*. 2013;62(1):102-111.
10. Warndorf MG, Kurtzman JT, Bartel MJ, et al. Early fluid resuscitation reduces morbidity among patients with acute pancreatitis. *Clin Gastroenterol Hepatol*. 2011;9(8):705-709.
11. Wu BU, Hwang JQ, Gardner TH, et al. Lactated Ringer's solution reduces systemic inflammation compared with saline in patients with acute pancreatitis. *Clin Gastroenterol Hepatol*. 2011;9(8):710-717e1.
12. da Costa DW, Bouwense SA, Schepers NJ, et al; Dutch Pancreatitis Study Group. Same-day admission versus interval cholecystectomy for mild gallstone pancreatitis (PONCHO): a multicentre randomised controlled trial. *Lancet*. 2015;386(1000):1261-1268.

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