

Major Complications of Small Bowel Diverticula

JOHN W. DONALD, M.D.

Complications of diverticula of the duodenum, jejunum and ileum, exclusive of Meckel's diverticula are extremely rare but can produce major diagnostic and therapeutic problems. Major reported complications include hemorrhage, perforation, biliary and pancreatic obstruction, and inflammation with intestinal obstruction. The mortality of complicated duodenal diverticula is reported from 33 to 48%. Our experience with some of these complications is reported. This experience and a review of other reported cases have led to the following recommendations for surgical treatment. 1) Massively bleeding duodenal diverticulum. Precise localization of the bleeding point by endoscopy and/or arteriography is highly desirable. Excision or partial excision of the diverticulum with suture ligation of the bleeding point is necessary. 2) Perforated duodenal diverticulum. Excision or partial excision, secure closure and drainage are necessary. If peri-Vaterian, a probe should be passed through the ampulla of Vater via the common duct. Unless an entirely satisfactory closure is achieved, complete diversion of the enteric stream from the duodenum by vagotomy, antrectomy with closure of duodenal stump, and Billroth II anastomosis is recommended. 3) Choledochal obstruction due to duodenal diverticulum. Choledochoduodenostomy. 4) Perforation, bleeding, or obstruction due to jejunal or ileal diverticulum. In rare cases, local excision of the diverticulum is feasible. Usually, resection of the involved segment with primary anastomosis is indicated.

COMPLICATIONS OF DIVERTICULA of the duodenum, jejunum, and ileum, exclusive of Meckel's, are extremely rare but can be serious and produce major problems in diagnosis and management. The complications that have been reported include severe hemorrhage, perforation, biliary and pancreatic obstruction, and inflammation with intestinal obstruction. Other more rare complications such as partial obstruction with malabsorption and blind loop syndrome have been recorded.

Duodenal diverticula are diagnosed in 1–5% of individuals undergoing barium study of the upper gastrointestinal tract. Most occur along the pancreatic border of the second, third and fourth portions of the duodenum which corresponds to the mesenteric border. Jejunal and acquired ileal diverticula also usually arise

From the Surgical Service of Mobile Infirmary and the Department of Surgery, University of South Alabama College of Medicine, Mobile, Alabama

from the mesenteric border of the small bowel as opposed to the Meckel's diverticulum arising from the antimesenteric border.

The finding of a duodenal or jejunal diverticulum is usually of passing interest only and no clinical significance is suspected. However, the fact that major complications can occur should not be overlooked and one must always be alert to the possibility of these complications and be prepared to perform the appropriate surgical procedure if they are encountered. The precise diagnosis is usually not made preoperatively and at times is difficult to make intraoperatively—especially in the case of perforation or massive hemorrhage from a duodenal diverticulum.

Case Reports

Case 1. A 56-year-old man had sudden severe pain in the right upper quadrant of the abdomen. The patient's pain persisted and required narcotics for partial relief. A few hours later, when examined at hospital admission, the patient had marked tenderness and muscle rigidity in epigastrium and right upper quadrant of abdomen. WBC was 16,600/mm³ with 52% segmented neutrophils and 33% stabs. Abdominal x-rays revealed no definite free air. The preoperative diagnosis was perforated duodenal ulcer or acute obstructive cholecystitis, but operative findings revealed a retroperitoneal inflammatory process lateral to the duodenum. The Kocher maneuver and reflection of hepatic flexure of colon enabled us to determine that a perforated duodenal diverticulum in the second portion of the duodenum was the cause of the patient's acute illness. The diverticulum was excised and the defect closed in two layers. The duodenal wall in this area was indurated and friable. A large penrose drain was inserted near the area of the excised diverticulum. On the sixth postoperative day, the patient developed drainage indicative of a duodenal fistula but this closed spontaneously four days later. He also developed a wound infection which responded well to simple drainage. He has remained free of gastrointestinal symptoms for 14 years.

Comment

The retroperitoneal phlegmon lateral to the duodenum was the clue to diagnosis in this patient. The

Reprint requests: John W. Donald, M.D., 192 Louiselle Street, Mobile, Alabama 36607.

Submitted for publication: January 2, 1979.

duodenal fistula complication was minimal in this case but because of the high incidence of this in other reported cases, we believe strong consideration should be given to complete diversion of the intestinal stream from the duodenum when one is treating a perforated duodenal diverticulum.

Case 2. The patient, a 70-year-old woman, was admitted to the hospital with severe pain and tenderness in the epigastrium. She had low grade fever and slight leukocytosis. She was treated with nasogastric suction and antibiotics and the symptoms and abdominal signs subsided after three days. A GI series revealed numerous large duodenal diverticula but no definite perforation. Barium enema and intravenous cholangiogram (patient had previous cholecystectomy) were normal. She was discharged on medical management with bland diet and antacids. She continued to have tenderness in upper abdomen and after two weeks, a deep mass could be felt in the epigastrium beneath the upper portion of right rectus muscle and she was readmitted for exploration. Operation revealed a perforated duodenal diverticulum in the second portion of the duodenum, the perforation being confined by adherence to the liver and surrounding inflammatory process. The perforated diverticulum was excised and the defect closed with an inner layer of chromic catgut and outer layer of interrupted silk. The closure was somewhat tenuous due to the inflammatory process and because of this, we elected to completely divert the intestinal stream from the duodenum by vagotomy and antrectomy with Billroth II anastomosis. She had no postoperative complications and has remained well for the past seven years.

Comment

The diagnosis was not made initially in this patient but the development of a tender mass two weeks later led to the exploration and diagnosis. Following excision of the diverticulum and diversion of the intestinal stream from the duodenum, she had no postoperative difficulty.

Case 3. The patient, a 65-year-old woman, was admitted to the hospital with a massive upper GI hemorrhage manifested by shock, hematemesis and black stools. Nasogastric suction revealed dark blood and at times, red blood. Endoscopy was not available at that time but gastric lavage with iced saline and other conservative measures did not stop the bleeding. A total of 4,000 cc of blood was given over an eight hour period because of the rapid blood loss. Emergency operation was performed and after abdominal exploration revealed no definite source of the hemorrhage, a pyloro-duodenotomy was done but no bleeding point was found. There was no ulcer but a duodenal diverticulum in the second portion of the duodenum was noted to be filled with fresh blood. This was explored but it was found not to be the source of bleeding. The blood was coming from a more distal point in the duodenum. The hepatic flexure of colon was mobilized and the duodenum reflected to the left. The dissection was continued medially until the second portion of the duodenum and the pancreas could be mobilized superiorly and the third portion of the duodenum visualized. A large diverticulum in the distal duodenum was visualized and was filled with red blood. When opened, there was active bleeding from a small ulcer in the diverticulum. The diverticulum was partially excised and there seemed to be cessation of the bleeding. The duodenal wall was closed with two layers of sutures. Because of the extensive duodenal dissection and the diverticulum in the second

portion which had been partially excised, we performed a vagotomy, antrectomy, closure of duodenal stump and gastrojejunostomy. This was a long, difficult operation and 3500 cc of blood were administered to the patient during the procedure. Her postoperative course was complicated by deep venous thrombosis and pulmonary embolism treated with heparin. After approximately 60 days, the patient was discharged but returned one week later with acute acalculous cholecystitis which was treated by cholecystostomy due to her critical condition. A postoperative tube cholecystogram showed no obstruction of the common duct. The cholecystostomy tube was removed and patient was discharged but due to continued drainage of large amounts of bile from the wound she was readmitted four weeks later and reoperation performed. There was an inflammatory mass in the region of the distal common duct and proximal duodenal region. Because of this, we decided to bypass this area by performing a cholecystojejunostomy. The patient recovered and was discharged from the hospital but 10 days later died suddenly, apparently from another pulmonary embolus.

Comment

The inflammatory process in the region of the partially excised nonbleeding duodenal diverticulum in the second portion of the duodenum probably contributed to some of the patient's postoperative difficulty. Although no obstruction of the common duct was noted on tube cholecystogram, we believe the continued drainage of bile from the cholecystostomy wound was related to this. This again emphasizes the extreme care which must be exercised in excising a periVaterian diverticulum (See Discussion).

Case 4. The patient, a 66-year-old woman, had repeated attacks of upper abdominal discomfort, nausea, vomiting and light colored stools. Cholecystectomy for cholelithiasis had been performed seven years prior to admission. Hospital admission and work-up two months before revealed a dilated common duct but no other abnormality. She was readmitted at this time with similar symptoms, occurring approximately every two days. Repeat barium studies revealed a large duodenal diverticulum arising from the postbulbar portion of the duodenal loop. Intravenous cholangiogram again showed a common duct dilated to 2.5 cm (Fig. 1). Bilirubin was not elevated but because of the persistent symptoms and repeated demonstration of a dilated common duct, exploration was advised. The common duct was dilated to 2.5 cm and a large duodenal diverticulum was exposed after performing the Kocher maneuver. Cholangiogram revealed no dye entering the duodenum (Fig. 2) but after an additional injection of 30 cc of dye, a small amount entered the duodenal diverticulum (Fig. 3). We believed the diverticulum was responsible for the intermittent common duct obstruction and we performed a choledochoduodenostomy. The patient's postoperative course was uncomplicated and she has been relieved of her symptoms for the past seven years.

Comment

Although the bilirubin was not elevated, we believe the operative findings indicated the duodenal diverticulum was causing the marked dilatation of the common duct. Rather than the more hazardous direct approach to the diverticulum, we elected to perform a choledochoduodenostomy.

Case 5. A 61-year-old woman developed sudden severe pain in the left side of abdomen opposite the umbilicus and a few hours later, vomited bile stained fluid. She vomited several times and was admitted to the hospital. Slight abdominal distention was noted and there was moderate tenderness in the left side of the abdomen. Abdominal films revealed a moderate amount of small bowel gas with a few air fluid levels. Some gas was present in the colon. The patient was treated with nasogastric suction and observation. During the next 12 hours, there was 3,000 cc of thick bile stained drainage from the nasogastric tube. The patient's abdomen was slightly more distended and the moderate tenderness in the left side of the midabdomen persisted. Repeat abdominal films showed persistent small bowel distention and less colon gas. Surgery was then advised and revealed a high small bowel obstruction due to an inflamed jejunal diverticulum which was adherent to the mesentery of the splenic flexure of colon (Fig. 4).

The inflamed diverticulum was dissected from the mesocolon and resected with closure of the jejunum with an inner layer of catgut and outer layer of interrupted silk. The freeing and excision of this diverticulum relieved the obstruction. She had no postoperative complications and was discharged on the tenth postoperative day.

Comment

This jejunal diverticulitis (because of adherence to the mesocolon) caused jejunal obstruction. Excision of the diverticulum relieved the problem in this patient but resection of the involved segment is more commonly performed.

Case 6. A 23-year-old man had recurrent attacks of abdominal pain for the past two to three years. Abdominal x-rays taken because of the pain two years before present admission showed a few dilated loops of small bowel but the patient's symptoms subsided. The present attack was more severe and prolonged than others. Abdominal examination revealed moderate distention, mild generalized tenderness but most marked in the left lower quadrant. Peristalsis was high pitched and abdominal x-ray films revealed findings compatible with low small bowel

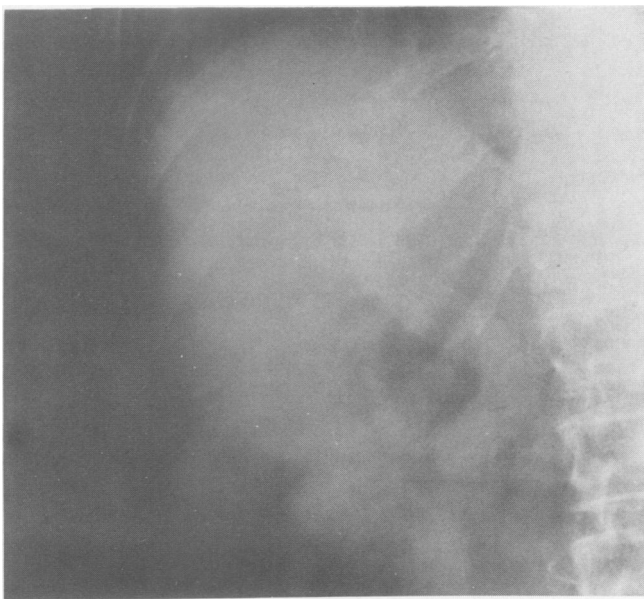


FIG. 1. Case 4. IV cholangiogram showing dilated common duct.



FIG. 2. Case 4. Operating table cholangiogram first injection with no dye entering duodenum.

obstruction (Fig. 5). Surgical exploration revealed a low ileal obstruction due to an extremely large diverticulum (apparently Meckel's) filled with inspissated vegetable matter which produced angulation and complete obstruction at the point of origin of the diverticulum (Fig. 6). The ileum distal to this was completely collapsed. A resection of approximately 14 inches of small bowel to include the diverticulum with end-to-end anastomosis was performed. The patient had a smooth postoperative course and has had no abdominal complaints since the operation (2 years ago).

Comment

Although this was probably a Meckel's diverticulum (not acquired), it is reported because of the unusual finding of intestinal obstruction due to filling of the large diverticulum with inspissated vegetable matter and the angulation at the point of origin of the diverticulum. Resection of this segment of ileum seemed the appropriate procedure in this patient.

Discussion

In 1952, Cattell and Mudge¹ reviewed 25 cases in which elective surgical procedures were done for duo-

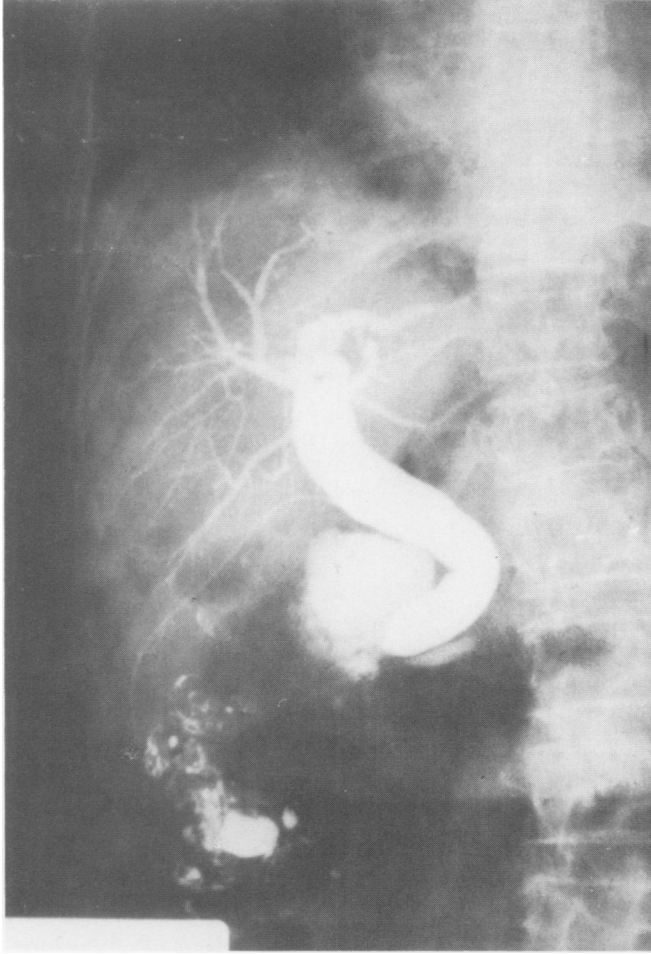


FIG. 3. Case 4. Filling of duodenal diverticulum after additional injection of dye.

denal diverticula at the Lahey Clinic. The diverticulum was excised in 24 of these cases, and his technique for exposure and excision continues today as one to be remembered. Most of these operations were performed for chronic symptoms thought to be due to the diverticulum and were not performed as emergency procedures for major complications. Cattell¹ found that these elective operations were accompanied by a significant mortality (8% in his series), and his results (approximately 50% considered excellent) in relief of symptoms emphasize the difficulty in the selection of nonemergency cases for surgery.

The relationship of biliary tract disease and duodenal diverticula has been pointed out by Landor and Fulkerson⁶ in 1966, and the suggestion is made that these diverticula can cause symptoms indistinguishable from biliary calculous disease. Neel¹⁰ has reported two cases of obstruction of the common duct relieved by excision of the diverticulum. Solhang and Semb¹⁵ have reported the operative mortality with excision of the diverticulum as high as 30%—due primarily to duodenal fistula or impairment of pancreatic drainage and resultant

complications. They state that until 1960, operations for common duct obstruction due to a duodenal diverticulum have been reported in 14 patients (36% mortality). Excision or invagination with closure of the muscular defect was done in most of these. The authors add one additional case to this series and in view of the high mortality rate of direct surgical approach to the diverticulum, the authors recommend sphincteroplasty rather than excision of the diverticulum.

Willcox¹⁸ has reported nine cases of bile duct obstruction due to duodenal diverticula. Three patients were managed by dilators through common duct, three by duodenotomy and surgical enlargement of the narrow obstructed neck of the diverticulum, and two patients were managed by choledochoduodenostomy.

McSherry and Glenn,⁷ in 1970, reported two cases of duodenal diverticula causing biliary tract obstruction and in one of them, the diverticulum was excised. They state that the mechanism of obstruction is two-fold. The common duct may drain directly into a diverticulum at the ampulla of Vater which can produce bile stasis, stone formation or infection. The other

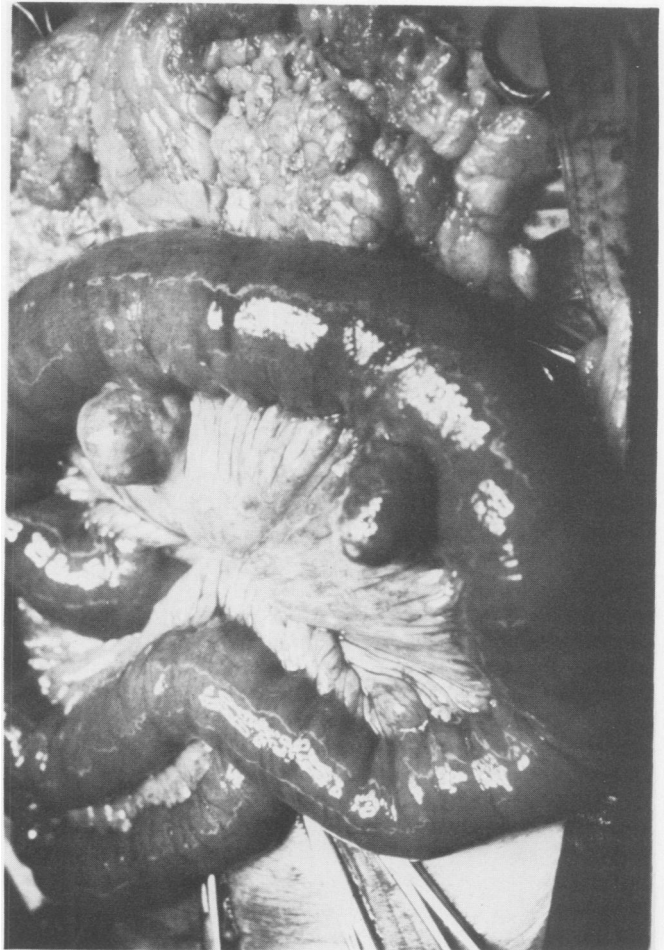


FIG. 4. Case 5. Proximal jejunum after freeing inflamed diverticulum (right) from mesocolon. (Note uninflamed diverticulum on left).

mechanism of obstruction is due to compression of the intraduodenal portion of the common duct by a diverticulum distended with duodenal contents which originates adjacent to the ampulla of Vater. Details of their careful technique in excising the diverticulum are given in their report.

Due to technical difficulties and considerable morbidity and mortality in excision of these diverticula for relief of common duct obstruction, we would recommend choledochoduodenostomy, as was performed in Patient 4. This seems to be a safer procedure and should relieve the common duct obstruction.

In 1961, Zeifer and Goersch¹⁹ reviewed the world literature on perforated duodenal diverticula and added one case. Twenty-two cases were diagnosed and the mortality rate was 48%. They recommended excision of the diverticulum but leaving sufficient cuff at the base to allow turn in of edge without tension. Their other suggestion is that the common duct should be intubated if there is any question about point of entry, and common duct drainage should be performed. Gas-

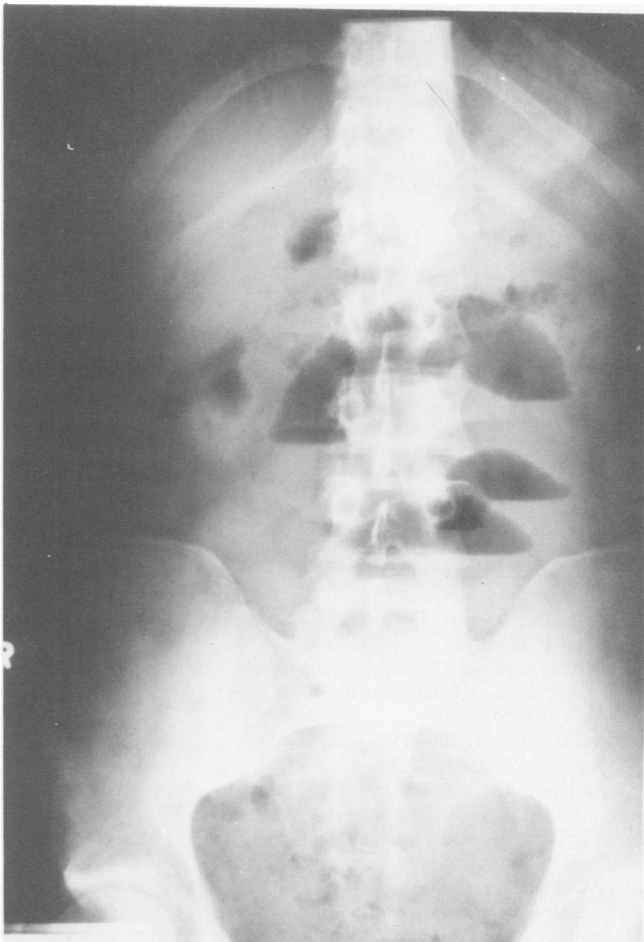


FIG. 5. Case 6. Erect abdominal x-ray showing numerous air-fluid levels and dilated small bowel.

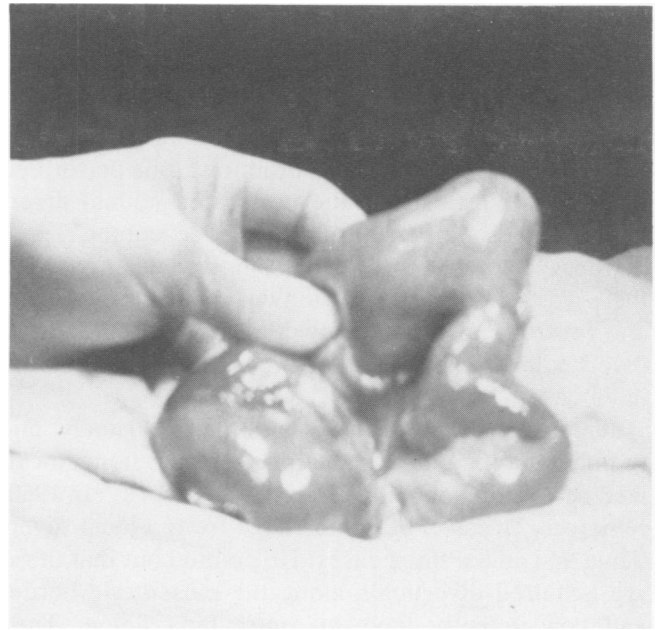


FIG. 6. Case 6. Ileal diverticulum filled with inspissated vegetable matter producing angulation and obstruction.

trostomy and feeding jejunostomy were also recommended.

Others who have reported cases of perforated duodenal diverticulitis include Graves, et al.³ and Wilkinson and Greaney.¹⁷ Of the five cases reported by Wilkinson and Greaney,¹⁷ there were two deaths. They advise passing a probe or dilator through the ampulla of Vater via choledochostomy to assist in the excision of these periVaterian diverticula. The case reported by Ettman and Kongtawng² illustrates perforation of a duodenal diverticulum with coexisting pancreatitis and massive gastrointestinal hemorrhage.

A precise diagnosis at the time of operation is often difficult and it should be emphasized (as has also been mentioned by Wilkinson and Greaney¹⁷) that retroperitoneal phlegmon lateral to the duodenum is often the only finding until the duodenum is mobilized.

In our cases, the perforated diverticulum was partially excised and closed in one case resulting in a duodenal fistula which closed spontaneously in three to four days. In the other patient, in addition to excision of the diverticulum, vagotomy and antrectomy with Billroth II anastomosis were done without post-operative complication.

Massive hemorrhage from a duodenal diverticulum is extremely rare and the surgical approach is most difficult. Herrington,⁴ in 1958, reported a case of successful excision of a massively bleeding diverticulum in the third portion of the duodenum after demonstration of the diverticulum by preoperative barium study. As in Patient 3 in our series, finding the exact source of bleeding and subsequent hemorrhage control can be

arduous. Miller, et al.,⁸ in 1970, reported eight cases of small bowel diverticula with serious complications. Two of these complications were due to a massively bleeding duodenal diverticulum (one was resected and the other stopped spontaneously). The other six cases were: three common duct obstructions, one perforated duodenal diverticulum, one perforated jejunal diverticulum, and one perforated ileal diverticulum. Three of these eight patients died from complications and there was serious morbidity in two other cases. Munnell and Preston,⁹ in 1966, reviewed complicated duodenal diverticula and reported an overall mortality of 33% in 75 cases.

Jejunal diverticula complications are usually due to inflammation and obstruction with occasional localized perforation or hemorrhage. Shackelford,¹³ in 1960, reviewed 21 cases of hemorrhage from jejunal diverticula and added three cases. He pointed out that these are acquired diverticula along the mesenteric border and consequently have no muscularis lining. They occur where the blood vessels penetrate the bowel wall and the lack of muscularis exposes the vessel to such an extent that any trauma may cause bleeding.

Perforation of an acquired diverticulum of the jejunum was reported by Herrington⁵ in 1962. Nobles,¹¹ in 1971, reported on 15 patients who underwent jejunal resection for serious complications of jejunal diverticulosis. Five of these patients had intestinal hemorrhage and five others had acute diverticulitis. Three patients were explored for intractable abdominal pain and in both instances, resection of jejunal diverticula corrected the problem. Nobles emphasized that the triad of obscure pain, anemia and dilated loops of jejunum should alert the clinician to the possibility of jejunal diverticulosis.

Obstruction of the distal portion of the small intestine by a concretion that had originated in a jejunal diverticulum was reported by Ottinger and Carter.¹² Two cases of perforated diverticulitis (one in jejunum and one in proximal ileum) have recently been reported by Smith.¹⁴ Viar and Donald¹⁶ have reported three cases of symptomatic jejunal diverticula and two of these had acute inflammation. All were treated by resection.

We encountered two patients with obstruction in our series—one due to an inflamed jejunal diverticulum and one due to a large, most unusual, Meckel's diverticulum with inspissated food particles.

In view of our experience with these cases and from the information presently available, we recommend the surgical management of these complications as follows:

1) *Massively bleeding duodenal diverticulum*: If possible, precise localization of the bleeding point by endoscopy or arteriography and then, after careful exposure, excision or partial excision of the diverticulum with secure control of the bleeding point.

2) *Perforated duodenal diverticulum*: Excision or partial excision, closure, and drainage. If periVaterian, a probe should be passed through the ampulla of Vater via the common duct for protection of the entrance of the duct. Due to the high incidence of duodenal fistula secondary to the inflammatory process and insecure closure, we believe strong consideration should be given to complete diversion of the intestinal stream from the duodenum by vagotomy, antrectomy with closure of duodenal stump, and Billroth II anastomosis.

3) *Common duct obstruction due to duodenal diverticulum*: Because of the hazards of a direct approach to the diverticulum, we believe this complication can be more safely managed by choledochoduodenostomy.

4) *Perforation, bleeding, or obstruction due to jejunal or ileal diverticulum*: In rare cases, local excision of the diverticulum but in most instances, resection of the involved segment with primary anastomosis is preferable.

References

- Cattell, R. B. and Mudge, T. J.: The Surgical Significance of Duodenal Diverticula. *N. Engl. J. Med.*, 246:317, 1952.
- Ettman, I. K. and Kongtawng, T.: Massive Gastrointestinal Bleeding and Perforation of a Duodenal Diverticulum with Coexisting Pancreatitis. *South. Med. J.* 70:761, 1977.
- Graves, H. A., Durrett, D. W. and Holcomb, G. W.: Perforated Duodenal Diverticulitis. *Am. J. Surg.*, 112:908, 1966.
- Herrington, J. L.: Massive Hemorrhage Resulting from Benign Ulceration in a Primary Duodenal Diverticulum. *Surgery*, 43:340, 1958.
- Herrington, J. L.: Perforation of Acquired Diverticula of Jejunum and Ileum. *Surgery*, 51:426, 1962.
- Landor, J. H. and Fulkerson, C. C.: Duodenal Diverticular Relationship to Biliary Tract Disease. *Arch. Surg.*, 93:182, 1966.
- McSherry, C. K. and Glenn, F.: Biliary Tract Obstruction and Duodenal Diverticula. *Surg. Gynecol. Obstet.*, 130:829, 1970.
- Miller, R. E., McCabe, R. E., Saloman, P. F. and Knox, W. G.: Surgical Complications of Small Bowel Diverticular Exclusive of Meckel's. *Ann. Surg.*, 171:202, 1970.
- Munnell, E. R. and Preston, W. J.: Complications of Duodenal Diverticula. *Arch. Surg.*, 92:152, 1966.
- Neel, H. B.: Obstruction of the Common Bile Duct. Duodenal Diverticular. *Minn. Med.*, 55:1118, 1972.
- Nobles, E. R.: Jejunal Diverticula. *Arch. Surg.*, 102:172, 1971.
- Ottinger, L. W. and Carter, E. L.: Obturation of the Ileum by a Jejunal Diverticular Enterolith. *Gastroenterology*, 68:1596, 1975.
- Shackelford, R. T. and Marcus, W. Y.: Jejunal Diverticula—A Cause of Gastrointestinal Hemorrhage. *Ann. Surg.*, 151: 930, 1960.
- Smith, J. S.: Jejunal Diverticula—Subtle Cause of Acute Abdomen. *Pa. Med.*, 79:60, 1976.
- Solhaug, J. H. and Semb, B. K.: Duodenal Diverticulum with Intermittent Biliary Stasis. *Acta. Chir. Scand.*, 140:670, 1974.
- Viar, W. N. and Donald, J. M., Jr.: Jejunal Diverticulitis. *J. Med. Assoc. State Ala.*, 35:705, 1966.
- Wilkinson, G. and Greaney, E. M.: Perforated PeriVaterian Duodenal Diverticulitis. *Am. J. Surg.*, 111:351, 1966.
- Willcox, G. L. and Costopoulos, L. B.: Entry of Common Bile and Pancreatic Ducts into a Duodenal Diverticulum. *Arch. Surg.*, 98:447, 1969.
- Zeifer, H. D. and Goersch, H.: Duodenal Diverticulitis with Perforation. *Arch. Surg.*, 82:128, 1961.