Intramural Hematoma of the Duodenum *

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This communication reviews 31 cases of intramural hematoma of the duodenum reported in the literature from 1838 to 1962 and adds two additional cases seen at The New York Hospital. Lesions of the small intestine inflicted by nonpenetrating blunt force have long been recognized.

According to Vance,[36] Aristotle over 300 years before the birth of Christ observed that the intestine of a deer is so fragile that a slight blow will rupture it without injuring the skin. In reviewing 1,476 cases of intestinal injury due to nonpenetrating abdominal trauma, Poer and Woliver [28] found that 115 (8.0%) involved the duodenum.

Intramural hematoma of the duodenum is an unusual, clearly defined injury which is apt to be overlooked, even at laparotomy. It may be spontaneous, but much more often is the result of trauma. A localized collection of blood extravasates into the subserosal, submucosal, and interstitial intestinal layers. In the duodenum the arteries and veins course mainly deep to the muscular layers. The duodenum is fixed at its junction with the stomach and the jejunum. The ligament of Treitz marks the latter junction. Because the duodenum crosses the unyielding vertebral column, it is particularly vulnerable to nonpenetrating trauma, which may divide it or, in lesser injury, may give rise to hematoma in the subserous or submucous layers. As this hematoma grows, it extends up and down the wall of the duodenum, compressing the mucosa and obstructing the duodenum. It may rupture and give rise to a subperitoneal hemorrhage, which, in turn, may rupture into the free peritoneal cavity.

When the hematoma is exposed, it appears as a large, tense, black, sausage-shaped mass varying in length according to the individual case and usually thought to be gangrenous bowel. When touched, it may immediately burst, extruding a quantity of dark blood and clots. As the mucosa usually remains intact, there is no spillage of intestinal contents; in fact, the hematoma partially or completely obstructs the duodenum and sometimes the common bile duct.

Preoperative diagnosis of hematoma or recognition of its presence at operation requires an awareness of the possibility of such a process. Without roentgenographic examination an accurate preoperative diagnosis is most difficult. This condition is most often confused with a ruptured spleen or acute appendicitis. In several reports, operation was carried out for acute appendicitis and the appendix removed only to have a later operation for hematoma of the duodenum.

The majority of hematomas occur in children (17 of 32) and almost all in males (26 of 33). The vast majority of patients have a history of trauma, such as that inflicted by the steering wheel of a car (three patients), falling from a bicycle (two patients), playing football (two patients),

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and injuries with tricycle, scooter, and wheelbarrow. The true history of trauma is frequently elicited only after careful questioning, once the condition is suspected or found at operation. The child may have disregarded the injury or may wish to conceal it. Hematoma of the duodenum occurs in alcoholics, who may be unreliable as far as history of injury is concerned. Frequent vomiting in a child who has no previous history of emesis, who appears well, and who shows few abnormal physical findings should arouse suspicion of this condition. When there is also a history of abdominal injury, suspicion should grow into alertness. Since the intestine is usually obstructed below the ampulla of Vater, bile may be present in the vomitus (6 of 33).

Examination may reveal some tenderness, spasm, or even a mass in the upper abdomen. The white blood cell count is elevated (10,000 to 31,000) with an increase largely in polymorphonuclear leukocytes and a shift to the left. Examination of the stool may show blood, and questioning may elicit a history of tarry or black stools.

Roentgen-ray findings are most helpful when viewed in the light of the history, physical examination, and a knowledge of the condition. There may be partial or complete obstruction of the stomach and duodenum; the latter may sometimes harbor an intramural mass, usually in the second or third part. Liverud,[16] in 1948, reported a case and showed beautiful films of obstruction and the characteristic features of intramural hematoma. After this earlier report, Felson and Levin,[10] in 1954, reported four cases and used the term "coiled spring" pattern of the mucosa, stating it to be pathognomonic. They assert that prior to their cases, no correct preoperative diagnosis had been made. They believe that blood or edema fluid infiltrates the mucosa, thickening the valvulae conniventes and producing the enlarged folds seen radiographically.

With correct diagnosis and treatment, the mortality is very low. Three of the reported cases were discovered at autopsy, and in another the patient had carcinoma of the pancreas and died, but in all the others the patients recovered. It is almost certain that many cases have not been reported or recognized.

This paper reports only those cases proven at operation or autopsy. There are reports where the diagnosis was determined by roentgen-ray examination and operation was not carried out.[38] There are others [33] where duodenal obstruction following operation was attributed to a retroperitoneal hematoma which might well have been a ruptured hematoma of the duodenum.

Although we are reporting only intramural hematomas involving the duodenum, this condition also occurs in the remainder of the small and large intestine. The junction of the upper jejunum with the duodenum at the ligament of Treitz is the most frequent site; another common one is the ileocecal region, with its unyielding pelvic brim.

Among 34 patients with intramural hematoma of the intestine, Spencer *et al.*[32] found that the condition occurred in the duodenum in 17 (50%), in the jejunum in five, in the ileum in three, in the large intestine in eight, and in the esophagus in one.

The anatomic association of the duodenum with the pancreas renders concurrent trauma to both organs likely. Frequently, it is difficult to differentiate pancreatitis from hematoma of the duodenum and, at times, both are present. Shallow and Wagner [30] report 28 cases of acute pancreatitis, one of which followed a nonpenetrating upper abdominal injury. This patient, a boy eight years of age, fell from a bicycle, striking his upper abdomen on the handlebars. The serum amylase reached a peak of 6,400 units (normal 80–180). Roentgenographic examination with barium showed no obstruction to the upper gastrointestinal tract. The patient recovered. Of

2,137 cases of acute pancreatitis reviewed by these authors, 62 were of traumatic origin, and they think trauma accounts for 2.0 to 4.0 per cent of the cases.

Naffziger and McCorkle [23] reported eight cases of trauma to the pancreas and found the serum amylase to be elevated above 180 Somogyi units in all.

Of the 31 cases from the literature and the two additional ones reported herein, one had an amylase of 600, one was associated with carcinoma of the pancreas, and three appeared in alcoholics, one of whom had questionable pancreatitis with an amylase at the upper limit of normal. Where the amylase determination was reported, it was always elevated or on the very high side of normal. Many of the alcoholics with hematoma may have been unwittingly injured or may have preferred to overlook an injury.

Hemorrhagic effects in various parts of the body have been reported following extensive use of anticoagulants in the treatment of heart and peripheral vascular disease. Wiot *et al.*[38] report two patients on anticoagulant therapy in whom symptoms and roentgenographic changes typical of hematoma of the duodenum developed. These recovered without operation. Culver *et al.*[6] report a similar patient with intramural hematoma of the jejunum who underwent laparotomy to rule out small bowel tumor.

McLachlan,[20] in 1838, reported a patient with a fatal false aneurysmal tumor occupying nearly the whole of the duodenum, who is thought to be the first one reported with hematoma of the duodenum. This 49-year-old man had frequent vomiting, and autopsy disclosed a huge stomach, 33 inches, along the greater curvature and 23 inches along the lesser curvature. Occupying the whole of the second and nearly the whole of the first part of the duodenum, seated between the mucosa and the muscular coat was a false aneurysm obstructing the lumen of the gut.

We have found 31 reported cases, all except four having been recognized in the last ten years, and are reporting two in addition.

Case Report

W. B. NYH 605588, a boy, ten years of age, was admitted for abdominal pain two days after striking his abdomen on a railing when he fell from the roof of a playhouse. His past history is important in that at age six he was examined because of the occurrence of large, elevated hematomata following minor injuries and excessive bleeding following a traumatic laceration. Family history included the fact that a maternal great uncle had bled for three days from the site of a dental extraction.

Studies of the coagulation status revealed normal values for bleeding time, clotting time, and prothrombin consumption. However, an abnormality was demonstrated by means of the thromboplastin generation test and could be rectified by addition of normal absorbed plasma to the test system. These studies and subsequent assays of antihemophilic globulin (AHG) content of the patient's plasma supported a diagnosis of mild hemophilia. The degree of coagulation defect was thought to be one which would be associated with minimal spontaneous bleeding but which would permit hemorrhage in situations of hemostatic stress, such as trauma or surgery.[14, 21]

One-and-one-half hours following the fall he complained of abdominal pain and was taken to another hospital, where the pain persisted, he vomited, and his hemoglobin began to fall. On the following day he became febrile, vomiting became more severe, and the serum amylase rose to 200.

Two days after injury he was admitted to The New York Hospital with a temperature of 38.5, pulse 124, respirations 24, and a blood pressure of 122/70. He was alert, lying with knees drawn up because of abdominal pain. The abdomen was flat and showed marked tenderness and guarding throughout. No organs or masses were palpable. Bowel sounds were absent. Both femoral pulses were active. Laboratory procedures yielded the following results: Hemoglobin 7.2 Gm., hematocrit 25 per cent, white blood cell count 7,750, red blood cell count 2,260,000, platelets 130,000, serum amylase 600.

At this time it was believed the lad had suffered an intra-abdominal injury, which might well be a ruptured spleen with marked blood loss, or because of the high serum amylase, a hemorrhagic pancreatitis. He was watched closely, blood loss

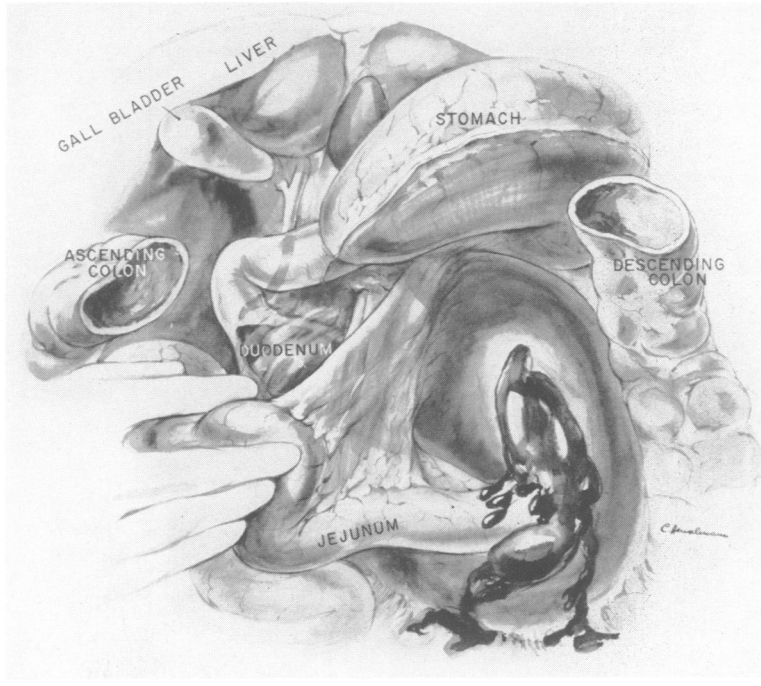

FIG. 1 (Case 1). Massive retroperitoneal hematoma with perforation of posterior peritoneum and hemorrhage into peritoneal cavity.

was replaced because of the known hemophilia, and fresh frozen plasma was administered every six hours. During the 11-hour period prior to surgery, bleeding could not be controlled by administration of amounts of plasma theoretically sufficient to establish an antihemophilic globulin level of 25 to 30 per cent.[3, 14, 27] This was evidenced by a value for hemoglobin concentration which was no higher after receipt of two units of sedimented erythrocytes than prior to institution of therapy. Therefore, surgical intervention appeared mandatory, with a preoperative diagnosis

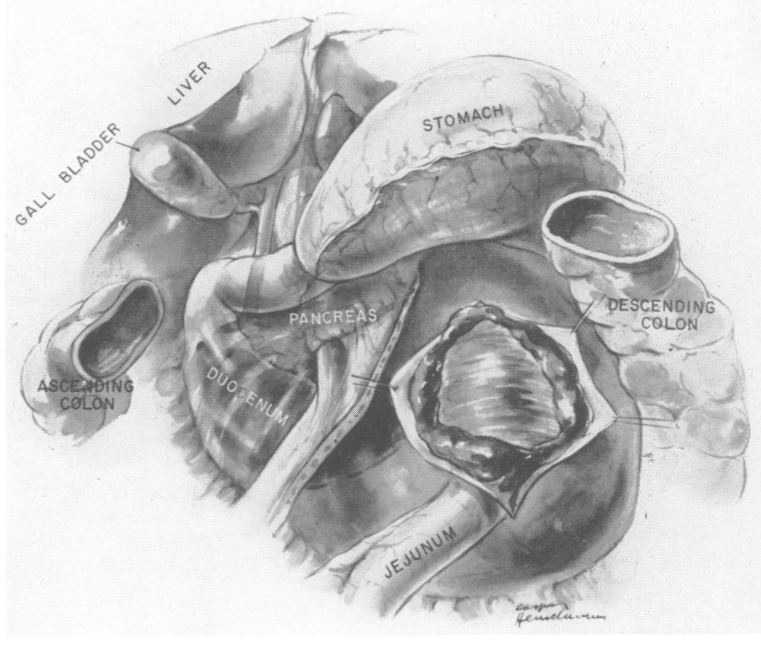

FIG. 2 (Case 1). Incision of posterior peritoneum with massive hematoma and marked disruption of duodenum and jejunum.

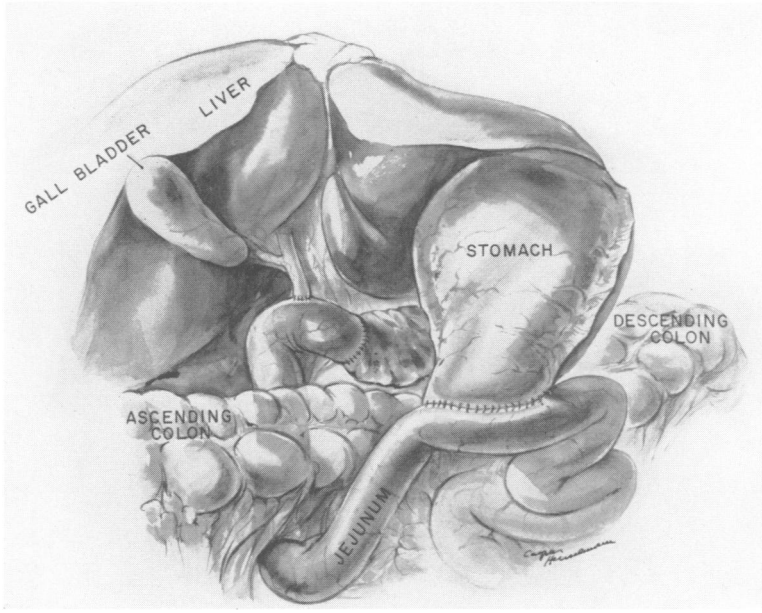

FIG. 3 (Case 1). Restoration of continuity of gastro-intestinal tract, Whipple procedure. Proximal jejunum is anastomosed to pancreas.

of ruptured spleen. A plain roentgen-ray film of the abdomen showed only a definite haziness.

Under general anesthesia a left subcostal incision was made and later a right subcostal extension was added. The distended abdomen contained some 700 cc. of dark blood. Visualization and palpation of the spleen gave no evidence of hemorrhage or clot in this region. The liver was inspected but found to be uninjured. A large retroperitoneal mass was then discovered in the most central portion of the abdomen in the region of the ligament of Treitz, with blood leaking through a defect in the peritoneum (Fig. 1). In the belief that one of the large vessels coming off the aorta might be ruptured, the posterior peritoneum was incised, and this disclosed a large blood clot which had obscured all landmarks by infiltration. The aorta was palpated posteriorly and found to be completely normal. Recognition of intestinal musculature (Fig. 2) made it possible to identify the mucosa and to realize that the hemorrhage was in the duodenal wall. Although the mucosa was badly mutilated, there was no evidence of leaking pancreatic or duodenal contents. The duodenum was then mobilized.

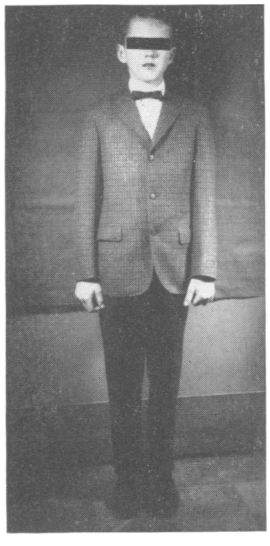

FIG. 4. Patient 18 months following operation.

The right side of the abdomen contained a large blood clot extending upwards almost to the common bile duct, which was visualized and found to be normal without evidence of perforation. Continuation of the dissection showed that the duodenum and a portion of the upper jejunum were largely destroyed by hemorrhage and would have to be removed. Starting at normal jejunum, the blood clot was removed, together with damaged intestine. The muscular wall of the duodenum and mucosa were left in place where possible, in an attempt not to damage the common bile or pancreatic ducts. When the ampulla of Vater was found to be out by itself on a peninsula of mucosa, it was obvious that the entire duodenum would have to be removed. This required division of the common bile and pancreatic ducts and a Whipple procedure. The common pancreatic duct was divided, as was the common bile duct proximal to the pancreas, and the distal stomach

resected. The proximal jejunum was sutured to the head of the pancreas about the pancreatic duct. The common bile duct was implanted in the jejunum 10 cm. distally. Thirty cm. distally to this the stomach was anastomosed to the jejunum, end-to-side (Fig. 3). During this procedure there was very little bleeding. The patient's hemophilia had been wonderfully controlled. Two cigarette drains were brought out through a stab wound and the abdominal wall closed with silk. Examination of the specimen showed large areas of intramural hemorrhage in the duodenum, grossly as well as microscopically, the bleeding being almost entirely in the submucosa.

Plasma therapy included lyophilized plasma (10 ml./kg.) administered 11 hours before surgery and again three hours later (5 ml./kg.). These amounts were designed to elevate the antihemophilic globulin level from the patient's usual value of 15 per cent to 25 to 30 per cent. Following admission to this hospital fresh frozen plasma (5 ml./kg.) was administered at four hour intervals since the half-life of antihemophilic globulin in the circulation has been estimated to be approximately four to nine hours.[2, 3, 9] Two such dosages were given prior to surgery. This interval of administration was maintained through the third postoperative day, was lengthened to six hours through the ninth day, and to eight hours on the tenth day. He was, therefore, protected during the period of surgery and during manipulations and removal of the drain which was inserted at the time of surgery. The patient did surprisingly well, and 20 days after operation was discharged from the hospital. Now, over two years later, he appears normal (Fig. 4).

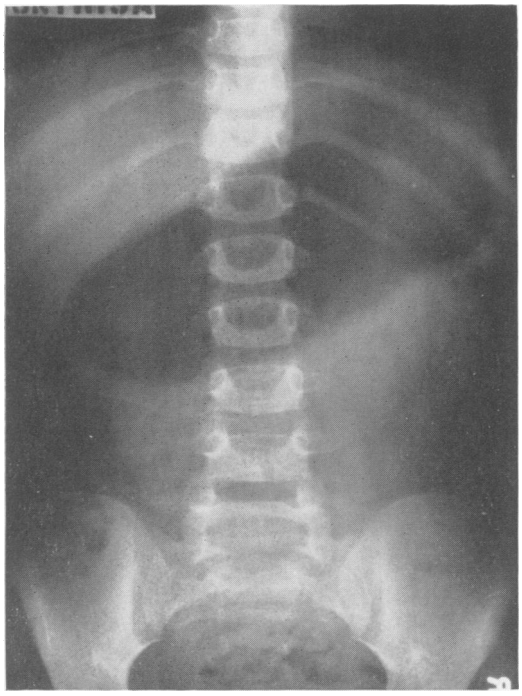

FIG. 5 (Case 2). Plain roentgenograph of abdomen showing dilatation of the stomach.

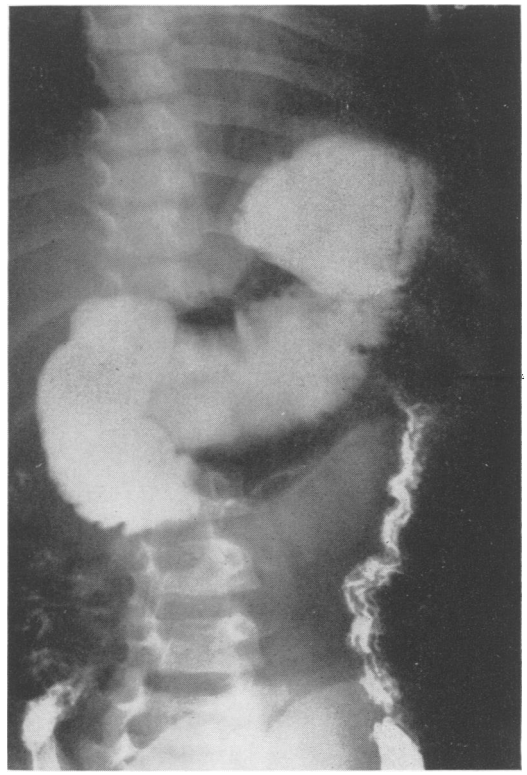

FIG. 6 (Case 2). Gastro-intestinal roentgenography showing obstruction to the duodenum thought to be caused by an annular pancreas.

L. F. NYH 98817. A three-year-old white girl with abdominal pain and vomiting was admitted for possible appendicitis. White blood cell count was 11,100. Four days previously she had hit her head on a swing and vomited repeatedly thereafter. The abdomen was soft with no tenderness, and the child said she was hungry. The day after admission she vomited everything taken by mouth and had no bowel movements. She was watched for three days, as lead poisoning or brain lesion was suspected. Roentgenographs showed a dilated stomach (Fig. 5) and an obstructive lesion in the region of the duodenum which was thought to be an annular pancreas (Fig. 6), and the child's mother now recalled that many of the child's stools had been black.

TABLE 1

Case	Year	Author	Age Sex	Amylase	Site	Etiology	Treatment	Result	WBC	Mass	Obstruction Stomach	Vomiting Bile
1	1838	McLachlan[20]	49 M		1st & 2nd	False aneurysm	Diagnosed at autopsy	Died		Yes	Marked	
2	1920	Strachan[35]	M		2nd & 3rd	Trauma	I. & D.	Well			Yes	
3	1933	Oppenheimer[21]	42 F		2nd & 3rd	Adenoca. pancreas. Fat necrosis	Exploration	Died	31,000	Indef.	Complete	
4	1937	Glass[13]	7 days M		1st	? hemophilia	Diagnosed at autopsy	Died			Almost complete	
5	1952	Dey[8]	6 F		1st & 2nd	No trauma	I. & D.	Well		Yes		Yes
6	1953	Stirk[31]	9 M		2nd, 3rd, 4th	Trauma	I. & D.	Well	16,200	Yes	Complete	
7	1954	Magladry, *et al.*[17]	9 M		2nd	Trauma	I. & D.	Well	12,600		Partial	Yes
8	1954	Felson, *et al.*[10]	18 M	646	Distal duodenum	Trauma football	Evacuation	Well	14,000 8,600			
9	1954	Felson, *et al.*[10]	9 M		Transverse duodenum	Trauma	I. & D.	Well	18,600			
10	1954	Felson, *et al.*[10]	33 M		1st, 2nd, 3rd	No	I. & D.		16,200		Almost complete	
11	1956	Snider[31]	11 M	162	3rd	Trauma	Exploration	Well	16,600		Partial	
12	1956	Watanabe, *et al.*[37]	17 M		1st & 2nd	Trauma	I. & D. P.G.E.	Well			Partial	
13	1956	Watanabe, *et al.*[37]	12 F		Duodenum	Trauma	Operated	Well				
14	1957	Caird, *et al.*[4]	6 M		3rd & 4th	Trauma	I. & D. P.G.E.	Well	17,000	Yes	Complete	Yes
15	1957	Spencer, *et al.*[32]	4 M		2nd & 3rd	Trauma	I. & D.	Well	10,900	?	Complete	No
16	1957	Patton[25]	21 M		Entire duodenum	Trauma	Duodenectomy					
17	1958	McClelland, *et al.*[18]	4 F		2nd & 3rd	Trauma	I. & D.	Well				

TABLE 1—(*Continued*)

Case	Year	Author	Age Sex	Amylase	Site	Etiology	Treatment	Result	WBC	Mass	Obstruction Stomach	Vomiting Bile
18	1958	McClelland, *et al.*[18]	38 F	Upper limit normal	2nd & 3rd	Alcohol ? pancreatitis	Exploration	Well	13,400			Yes
19	1958	Garfinkel, *et al.*[12]	4 M		4th	Trauma	I. & D.	Well	15,000	mass on X-ray	Complete	
20	1958	Pester, *et al.*[26]	10 M		2nd	Trauma	I. & D.	Well			Complete	By suction
21	1959	Culver, *et al.*[5]	29 M		1st & 2nd	Alcohol ? trauma	Blood evacuated	Well		?	Partial	
22	1959	Ferguson, *et al.*[11]	24 M	172	1st & 2nd	Alcohol, ? trauma	Blood evacuated	Well	Normal		Almost complete	
23	1959	Rowe, *et al.*[29]	33 M		Entire duodenum	Trauma	I. & D. P.G.E.	Well	14,000		Complete	
24	1959	Bergman, *et al.*[1]	76 M		2nd	Cyst pancreas no trauma	Diagnosed at autopsy	Died				
25	1960	Kirkpatrick[15]	29 F		2nd & 3rd	Trauma	P.G.E.	Well		Yes	Almost complete	
26	1961	Davis, *et al.*[7]	19 M	200	2nd & 3rd	Trauma	I. & D.	Well	10,100			Yes
27	1962	Moore, *et al.*	10 M	600	Entire duodenum	Trauma	Whipple resection	Well	7,750		Partial	
28	1962	Moore, *et al.*	3 F		3rd & 4th	? trauma	Resection	Well	11,100		Almost complete	
29	1962	Mirov[22]	6 M		Entire duodenum	Trauma	I. & D.	Well	20,000		Partial	
30	1962	Mirov[22]	18 M		Entire duodenum	No trauma	I. & D. P.G.E.	Well	9,600			
31	1962	McIntyre, *et al.*[19]	6 M		Duodenum	Trauma	I. & D.			Yes	Complete	Yes
32	1962	McIntyre, *et al.*[19]	8 M		3rd	Trauma	I. & D.		25,000 11,500		Yes, of duodenum	
33	1962	McIntyre, *et al.*[19]	22 M	32	3rd	Trauma	P.G.E.		10,800			

Five days after admission, eight days after the injury, operation was carried out through a long right rectus incision. A large cystic, blue mass extended from the ligament of Treitz down almost to the ileocecal valve in the leaves of the small bowel mesentery. In an attempt to dissect this mass out, it was entered and found to be a large hematoma with dark red liquid and many old clots. Further dissection disclosed a loop of bowel 10 to 12 cm. long in the region of the ligament of Treitz. As this loop was nonviable, a resection was done, which included the third portion of the duodenum, the ligament of Treitz, and the proximal jejunum; an end-to-end anastomosis of duodenum to jejunum was performed. The pathological report stated that "although the mucosa of the small intestine is intact, in it and in the submucosa there is an intense hemorrhage. The muscularis is either obliterated by the extravasated blood cells or has been torn away. Diagnosis: infarct of the jejunum. Postoperative diagnosis: paraduodenal hernia." The child was discharged 13 days later and when seen eight months thereafter was well.

The two cases are of interest in that one involves the first reported patient with hemophilia complicating the intramural duodenal hematoma, although this was suspected in the case reported by Glass.[13] The damage to the duodenum was so great that for the first time in this condition, a Whipple procedure was necessary.

The true nature of the second patient's injury was not suspected at surgery. A house officer assisting at operation on the first case recalled the second and, on review, there is no question regarding its true diagnosis.

Wiot *et al.*[38] state that although no long-term follow ups have been reported, conservative therapy should be tried first. However, there are numerous reports of obstruction and narrowing of the duodenum, small and large intestine following intramural hematoma. Therefore, the large majority of authors recommend operation and advise removing the blood and blood clot and draining the area when resection is not necessary. Although gastroenterostomy has been performed to bypass the obstruction following evacuation of the hematoma, healing is much more rapid if blood is evacuated.

Summary

In addition to the two patients presented herein, we have found 31 patients with hematoma of the duodenum proven by operation or autopsy recorded in the literature. Of these 33 proven cases, 29 have been recognized in the last ten years. As more widespread knowledge of the condition leads to greater awareness of its possibility, there is no question that many more will be recognized both preoperatively and at surgery.

The increased use of anticoagulants in the treatment of cardiac and vascular disease will cause a rise in the incidence of hemorrhage into the duodenum as well as into other parts of the body. The condition may also be initiated by such diseases as carcinoma and pancreatitis.

Only at operation can the true nature and extent of the process be completely assessed and proper therapy applied. Roentgenography is a tremendous help in diagnosis but is not infallible, and these patients should undergo surgery, for even though they may recover from the initial injury, the healing process may well result in obstruction.

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