TRAUMATIC PANCREATITIS*

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THE SERUM AMYLASE TEST and the trend toward conservative management of acute pancreatitis represent the two recent advances which have widened the recognition of this disease, rendered its diagnosis more certain, and greatly reduced its mortality. Within the past four years 28 cases of acute pancreatitis have been encountered in the Jefferson Medical College Hospital, 20 of the edematous type and eight of the hemorrhagic type. In these, a conservative nonoperative method of treatment[1] was generally employed, reserving operation for the complications, namely, pseudocyst and abscess,[2] or for associated biliary tract disease. One case from this series is unique in that it followed a nonpenetrating upper abdominal injury. It afforded an unusual opportunity to apply the more recent concepts of diagnosis and treatment to a seldom-recognized and rare type of pancreatitis. Because of the sustained extremely high serum amylase values and the recovery without complications following conservative therapy, we are reporting the case in detail.

Case Report.—D. M., male, age 8, was admitted to the Jefferson Medical College Hospital, September 10, 1945, with the chief complaint of upper abdominal pain.

On September 1, 1945, nine days before admission, the patient fell from a bicycle, striking his upper abdomen on the handle-bars. This was followed by constant moderate upper abdominal pain, not accompanied by nausea or vomiting. On the following day the pain still persisted, accompanied by nausea and one episode of vomiting. He took only liquids and remained in bed all that day and the two succeeding ones. At no time was the pain severe enough to prevent sleep. Except for the first day after the accident the boy's appetite remained good and there were no nausea or vomiting. On the fourth day, because of the persistent mild upper abdominal pain, the family doctor referred the patient to the accident ward with a presumptive diagnosis of appendicitis. Examination at that time revealed a healthy looking boy with normal temperature, pulse and respirations. There was slight tenderness in the right upper and right lower abdominal quadrants and questionable muscle spasticity on this side which could be easily overcome. Rebound tenderness was absent and the rectal examination was negative. The white cell count was 9,000. He was referred to the care of the children's out-patient department.

The following day, the fifth after injury, the boy was free of pain and resumed moderate activity at home. During the ensuing three days the patient remained free of pain, had a good appetite, normal daily bowel movements, and normal color of the urine.

On the morning of the day of admission, nine days after injury, the boy was awakened from sleep by a severe constant periumbilical pain which radiated to both hypochondria. This pain caused him to remain very quiet in bed, doubled up. It was even more severe when he attempted to walk. There was no associated nausea or vomiting. He did not experience shoulder-top or back pain. At no time was blood noted in the stools or urine. Because of the constant severe upper abdominal pain the child was again brought to the hospital.

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Physical Examination.—The patient was a well-nourished boy lying with his knees and thighs flexed, complaining of abdominal pain. Temperature 100° F.; pulse 130; respirations 30; and blood pressure 100/70. The face was flushed but not cyanotic. The heart and lungs were normal. On inspection, the abdomen was scaphoid and showed no evidence of external injury. Diaphragmatic excursions were not visible and respirations were entirely thoracic. There were exquisite tenderness, rebound tenderness, and board-like rigidity in the entire upper abdomen and periumbilical area. There was slight muscle-guarding but no tenderness in the lower abdomen. The costovertebral angles were not tender on percussion. There were no visible or palpable abdominal masses. Peristalsis was hypoactive. Rectal examination, as well as the remainder of the physical examination, was negative.

The clinical impression was nonpenetrating upper abdominal trauma with secondary peritonitis.

Laboratory Data.—Examination of the blood showed hemoglobin 71 per cent; red cells 4,200,000; white cells 18,000, with polymorphonuclear cells 90 per cent (10 per cent young forms), eosinophils 1 per cent, lymphocytes 8 per cent, monocytes 1 per cent; and platelets 280,000. Urinalysis was negative. The serum amylase was 320 units (normal 80-180 units). A plain roentgenogram of the abdomen was negative.

Treatment and Progress.—In view of the nine-day interval since injury, the lack of an urgent indication for immediate surgical intervention, and the elevated serum amylase, a policy of watchful waiting was adopted. The vital readings were determined hourly. Slow intravenous administration of 1,000 cc. of 5 per cent glucose in normal saline was instituted. Because of the absence of nausea or ileus, Wangensteen suction was not deemed necessary. Penicillin was administered hypodermically every two hours, the total 24-hour dose being 100,000 Oxford units. During the ensuing 12 hours the pain decreased in intensity, with sedative drugs withheld; the blood pressure remained within normal limits; the pulse fell to 90, the respirations to 22, and the white cell count to 12,000; the abdominal signs became less marked; and a normal bowel movement occurred.

The following day the boy stated that he still had slight pain but was comfortable. There was a further decrease in the severity of the abdominal signs. The hemoglobin and red blood cell count remained essentially the same as on admission and the white cell count fell to 8,000. The serum amylase rose to 400 units. Since intestinal injury appeared unlikely; since signs of intra-abdominal hemorrhage were lacking; and since pancreatic injury, as evidenced by the abnormally high serum amylase, was sufficient to account for the findings, the conservative policy was continued. A record of the serum amylase fluctuations is shown in Chart 1.

During the first week the patient's condition gradually improved. Liquids and soft foods were well tolerated. The pain gradually disappeared altogether and the signs in the right upper abdominal quadrant subsided; but moderate tenderness, rebound tenderness, and rigidity persisted in the left upper quadrant. During the second week the same type of pain as well as the same physical findings noted on admission recurred. There was still no evidence of any upper abdominal mass. On the 10th day after admission the serum amylase reached a peak of 6,400 units, with a corresponding urinary amylase greater than 1,200 units. Repeated white blood cell counts were normal; repeated routine urinalyses were normal; the blood sugar was 66 mg. (14th day of admission); and the serum calcium was 10.1 mg. (15th day). Roentgenologic examination of the upper gastro-intestinal tract with barium on the 16th day of admission showed no evidence of obstruction and no evidence of extrinsic pressure on the stomach.

During the third week the patient again began to improve, and for the ten days prior to discharge on October 10, 1945, he felt well.

Follow-up.—The patient was last reëxamined, December 7, 1945, more than three months following the injury. He had remained entirely well following discharge from the hospital. The mother stated that his appetite was excellent and that it was difficult to restrain him from indulging vigorously in sports. Physical examination at this time was

normal. The serum amylase was less than 80 units and blood sugar 80 mg. Roentgenologic study of the upper gastro-intestinal tract with barium was again negative.

DISCUSSION.—Although trauma undoubtedly may cause acute pancreatitis, it is responsible for only a small percentage of cases. In Schmieden and Sebening's[3] collected series of 2,137 cases, 62 were of traumatic origin. In Truesdale's[4] series of 54 cases and in the authors' 28, only one could be directly attributed to trauma. From these figures trauma would seem to account for approximately 2–4 per cent of the cases.

Since the first recorded case of injury to the pancreas by Travers[5] in 1827, many single case reports have appeared. Most of these injuries, however, have involved other structures as well, such as the spleen, liver, stomach, bowel, kidney, gallbladder, common bile duct, aorta, vena cava, diaphragm, and lung. Thus, Naffziger and McCorkle[6] encountered associated injury in each of their five cases following nonpenetrating abdominal trauma. There was laceration of the spleen in two, laceration of the spleen and contusion of the kidney in one, laceration of the pylorus and first portion of the duodenum in one, and laceration of the third portion of the duodenum in one. Traumatic pancreatitis without injury to other organs is exceptionally rare. Garre,[7] in 1905, was able to collect only eight such cases from the literature. Schmieden and Sebening,[3] in 1928, found only 20 cases.

Traumatic pancreatitis may follow abdominal injury, either penetrating or nonpenetrating, and also surgical operative injury. The penetrating wounds are most commonly caused by bullets, knives or other pointed objects. Nonpenetrating wounds usually result from blows sustained in falls and fights, or by crushes. The force, whether penetrating or nonpenetrating, is usually anterior, but may be lateral or posterior. Surgical injury may follow operations upon the pancreas itself, as in biopsy or partial pancreatectomy, or on adjacent organs such as the stomach, duodenum, lower end of the common bile duct, or spleen.

Because of its soft parenchymatous and extremely vascular structure the pancreas may be contused or ruptured by what might seem insignificant trauma. Venable[8] classifies rupture as incomplete or complete. According to this author, incomplete rupture is a tear in the pancreas within an intact capsule. Complete rupture includes a tear in the capsule as well. Either type may or may not be associated with hemorrhage. Severance of the duct of Wirsung may occur, adding greatly to the gravity of the injury, and is usually followed by pancreatic fistula if the patient survives. The pancreatitis that develops may be either the edematous or hemorrhagic type. The hemorrhagic type is apt to be followed by pseudocyst or abscess formation.

As in the usual forms of pancreatitis the symptoms and signs are so variable and so inconstant that it is impossible to make the diagnosis definitely on clinical criteria alone. Any trauma to the upper abdomen should arouse suspicion of this lesion. Definite confirmation can be obtained by the serum amylase test, if the reading is well above the high normal of 180 Somogyi units. During the acute stage of pancreatitis values range from several hun-

dred to several thousand units. In the authors' case the level rose to 6,400 units, which, as far as we are aware, represents the highest value ever reported. It must be borne in mind that symptoms, as well as elevated serum amylase, may follow a latent interval of days or occasionally even weeks. The diagnosis is missed because the condition is not thought of and the serum

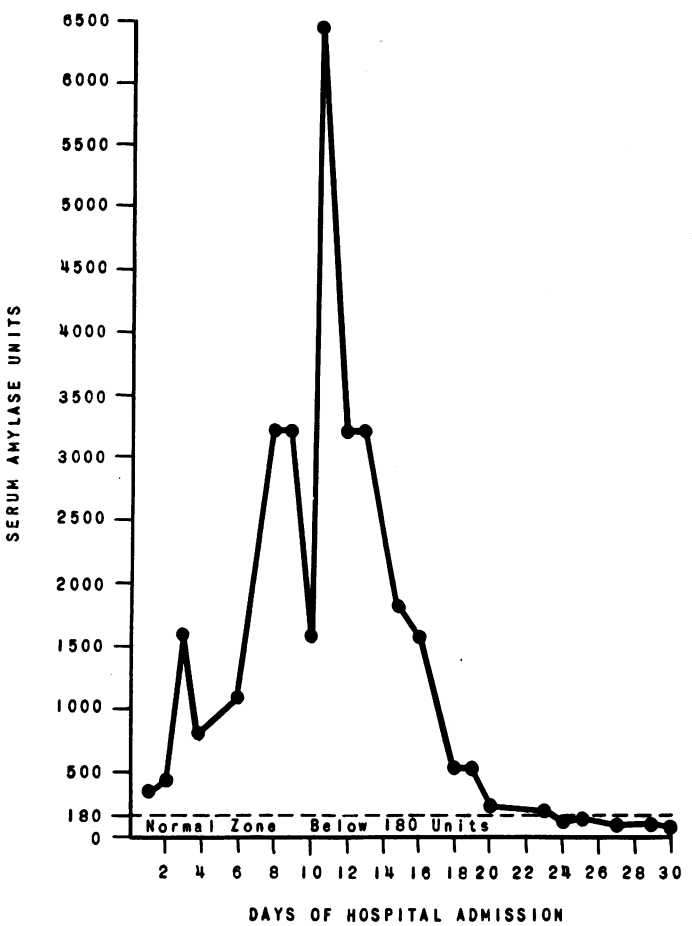

CHART 1.—Serum amylase elevations in authors' case, showing sustained extremely high values.

amylase test is not performed. In the authors' case the serum amylase was elevated on the ninth day following injury and remained elevated for three weeks thereafter (Chart 1).

According to Naffziger and McCorkle,[6] in most cases there is a rapid rise and fall of the serum amylase following pancreatic injury, probably corresponding to the period during which enzymes leak from the injured pancreas. Pinkham[9] believes that a sustained elevation of the serum amylase is suggestive

of the presence of a pancreatic collection. This author urges further clinical observation in such cases in order to derive more data on this point which might aid in the early diagnosis of pancreatic collections. The authors' case in which the serum amylase was sustained at abnormally high levels for three weeks would seem to represent an ideal case for cyst formation, yet this complication did not occur. Obviously the question of the relation of persistent serum amylase elevation to the development of a pancreatic collection can be settled only when many more carefully studied cases are available for analysis.

According to the recent work of Edmondson and Berne,[10] serum calcium findings below 9 mg. per 100 cc. of blood usually occur in cases of pancreatic necrosis some time between the 2d and 15th day of the disease, and values below 7 mg. indicate a fatal prognosis. In the authors' case, on the 15th day of admission, 23 days after injury, the serum calcium was 10.1 mg. at a time when the serum amylase was elevated to 1,600 units. This normal calcium value might be interpreted as indicating pancreatic edema rather than necrosis and certainly was in accord with the favorable outcome of the case.

It is taken for granted that penetrating abdominal wounds associated with pancreatic or other injury should be surgically explored. However, in the treatment of pancreatitis following nonpenetrating abdominal trauma, we believe that the same conservative nonoperative management as recently advocated for the more common forms of pancreatitis is preferable, if injury to important blood vessels and to adjacent organs as the spleen, liver, or gastrointestinal tract can be ruled out. Pancreatic repair is probably greatest when the gland is left undisturbed in a closed abdomen. Since the general reaction and toxemia which may occur result as a rule from primary nonspecific cellular destruction of the pancreas, operation has little to offer. The withholding of food, which acts as a stimulus to pancreatic secretion; Wangensteen suction to combat ileus; oxygen in severe cases; and intravenous administration of saline solution, glucose, amino-acids and vitamins support the patient during the vital period in which the complication of pancreatic collection either infected or noninfected may occur. Chemotherapy in the form of penicillin is a valuable adjunct in preventing secondary bacterial invasion.

If clinical improvement occurs within a few hours and persists, as in the authors' case, it is justifiable to continue a conservative policy of treatment. On the other hand, if the patient's condition becomes progressively worse during the ensuing 4–12 hours, surgical intervention is indicated, for further delay may prove disastrous. Lacerations following stab wounds and tearing injuries may be closed with black silk, but the contused lacerations following nonpenetrating injuries usually cannot be closed. In these instances Penrose drains should be placed in the lesser peritoneal cavity adjacent to the capsule of the injured pancreas and brought to the surface, either through the original incision or a separate one in the flank. The purpose of the drainage is to aid in prevention of diffuse peritonitis or formation of a pancreatic collection (hematoma, abscess, or pseudocyst).

Pseudocyst formation may occur weeks or months subsequent to the original injury. Pinkham[9] who reviewed recent series of pancreatic pseudocysts states that trauma is responsible for 20 per cent, or less, of the cases. Treatment of these is surgical, consisting of marsupialization of the cyst. Although the authors' case shows no evidence of this complication after three months, continued follow-up study is indicated to exclude it as a very late manifestation of traumatic pancreatitis.

SUMMARY AND CONCLUSIONS

1. Trauma accounts for approximately 2–4 per cent of cases of acute pancreatitis. Following an upper abdominal injury, acute pancreatitis should always be suspected. A latent period may intervene before appearance of symptoms.

2. Suspicion of traumatic pancreatitis should be confirmed by performance of the serum amylase test, the reliability of which, during the acute phase of pancreatitis, has become firmly established.

3. Operation is not necessary in all cases of pancreatitis following injury. The conservative nonoperative management which has greatly reduced the mortality in the usual types of pancreatitis is advocated for cases following nonpenetrating abdominal injury, if serious injury to other organs and massive hemorrhage can be ruled out.

4. Indications for surgical intervention are penetrating wounds; injury to important blood vessels; injury to adjacent viscera as spleen, liver or gastro-intestinal tract; failure to respond promptly to conservative management; or for subsequent pancreatic collections.

5. A case is presented and discussed in which the diagnosis was suspected clinically, confirmed by the serum amylase test, treated conservatively, and in which recovery ensued without complications.

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