

THE RECOGNITION AND MANAGEMENT OF ACUTE TRAUMA
TO THE PANCREAS: WITH PARTICULAR REFERENCE
TO THE USE OF THE SERUM AMYLASE TEST*

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THE PANCREAS is protected well by its deep situation within the abdominal cavity. Occasionally, however, it may be injured and, in a patient presenting signs of trauma to the upper portion of the abdomen, the possibility of such injury should be suspected. In some cases there may be no early evidence of damage to the pancreas; in others, signs from trauma to other abdominal viscera are likely to overshadow those arising from the pancreas. No particular group of symptoms or abdominal findings can be considered as diagnostic of injury to this organ. Recently, however, determination of the blood serum amylase has made it possible to recognize many such lesions (some of them only slight or moderate in extent) soon after they have occurred. This determination is made by the well standardized saccharogenic method of Somogyi, and his definition of the unit of blood serum amylase is used. During the last five years 1800 amylase determinations, including those in eight cases of trauma to the pancreas, have been made in the University of California Clinical Biochemistry Laboratory at the San Francisco Hospital. These cases illustrate trauma to the pancreas resulting from penetrating and nonpenetrating injuries to the abdomen and cases in which there was surgical trauma to the pancreas. In each instance of injury to the pancreas in which the determination was made, an elevation of the serum amylase above the maximum normal level (180 Somogyi units) was found at some time after the injury. This increase in the blood serum amylase following trauma to the pancreas probably results from leakage of the enzyme from the injured acini and ducts into the interstitial spaces, or into the peritoneal cavity, or both; thence, it is absorbed into the blood.

The case reports that follow illustrate several of the ways in which the pancreas may be injured and the consequent changes in the level of the serum amylase.

In Cases 1 and 2 the pancreas was injured by penetrating wounds of the abdomen.

CASE REPORTS

Case 1.—A male, age 37, received a stab wound in the epigastrium, the small opening just inferior to the xyphoid process penetrating into the abdomen. There

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was no abdominal tenderness or spasm. Five hours after injury, and before operation, the blood serum amylase was 241 units (Fig. 1). Celiotomy showed a laceration of the transverse mesocolon and a laceration, about 1.5 cm. in length, into the parenchyma of the pancreas, with a large hematoma and some necrosis of fat near the head of that organ. The lacerations were repaired and the hematoma was evacuated. A soft-rubber (gutta percha) drain was placed adjacent to the wounded pancreas and brought out through a small stab wound in the right flank.

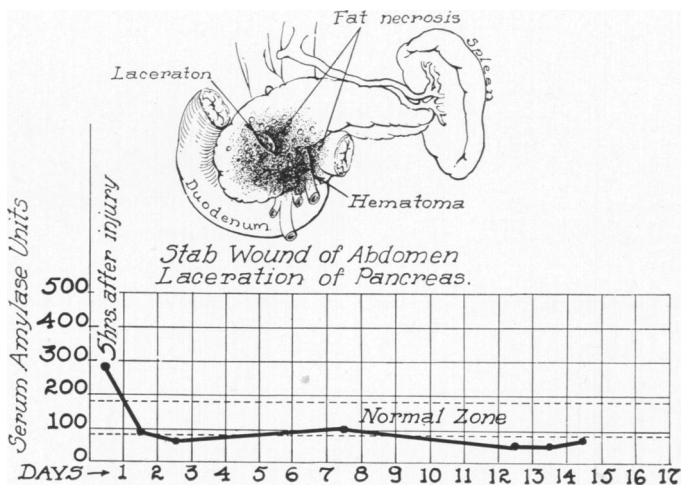


FIG. 1.—Case 1: Slight rise in serum amylase associated with a stab wound of the pancreas.

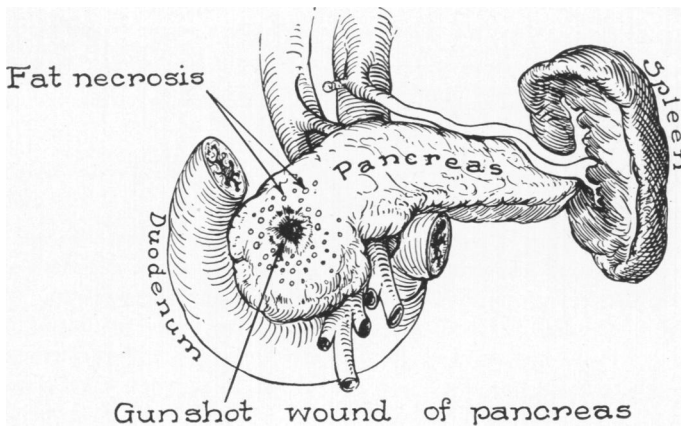


FIG. 2.—Case 2: Gunshot wound of the pancreas. The serum amylase was elevated.

Case 2.—One hour before his entry to the hospital a boy, age 12, was shot in the epigastrium with a 32-caliber pistol at a range of about 50 feet. He complained of severe abdominal pain and vomited three times. The wound of entrance was immediately beneath the costal margin about one inch to the left of the midline. The abdomen was explored through an upper left rectus incision. A considerable amount of hemorrhagic

fluid was found in the abdominal cavity, and the bullet rested between the coils of the small intestine. Perforations in the anterior and posterior walls of the stomach were closed with sutures. The lesser peritoneal cavity was soiled with gastric contents, and considerable necrosis of fat had occurred in this region. A deep wound was found in the head of the pancreas (Fig. 2). The head of the pancreas and the lesser sac were drained by cigarette drains brought out through the left rectus incision. Blood and urine amylase determinations were not made until the ninth postoperative day. A method somewhat different from that used at present was employed, but the results showed marked elevations in the amylase.

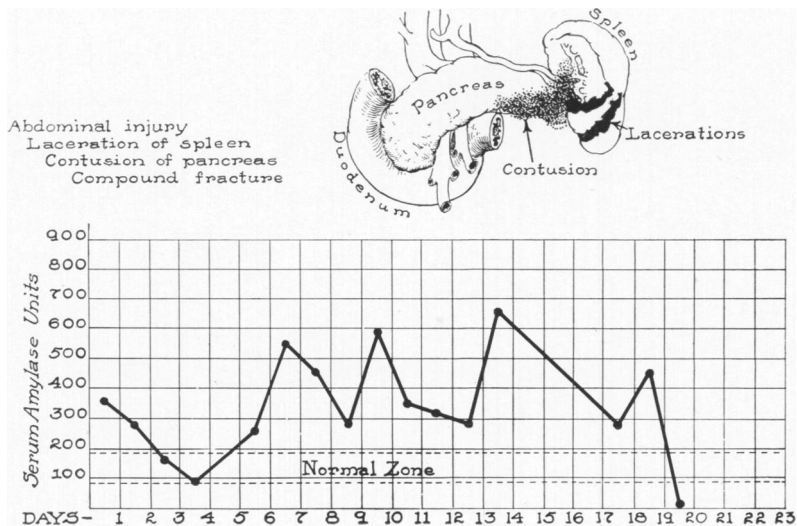


FIG. 3.—Case 3: Contusion of the pancreas following a nonpenetrating injury to the abdomen produced these elevations in the serum amylase. The readings were increased for the first two days after the injury and then subsided. On the fifth day the serum amylase again increased above normal and remained elevated for about two weeks. This probably indicated a recurrence and continuation of leakage of enzymes from the injured pancreas.

Cases 3 to 7 inclusive illustrate injuries of the pancreas resulting from nonpenetrating trauma to the abdomen.

Case 3.—A male, age 35, who had been struck by an automobile, was brought to the hospital with signs of hemorrhage, shock, a compound fracture of the leg and evidence of serious intra-abdominal injuries. The blood serum amylase was 363. After treatment for shock, the abdomen was explored through an upper left rectus incision. A large amount of blood was encountered. The spleen was lacerated extensively and the tail of the pancreas was contused and surrounded by hematoma. Splenectomy was performed and the compound fracture was débrided, reduced and immobilized. The abdomen was closed without drainage. Figure 3 shows the serum amylase studies in this case.

Case 4.—A male, age nine, was struck by an automobile about two hours before entering the hospital. There were signs of serious intra-abdominal injury with maximum findings in the upper left abdominal quadrant. Before operation the blood serum amylase was 2117 units. A lacerated spleen was removed through a left rectus incision. The abdomen contained 300 cc. of bloody fluid. The tail of the pancreas was enlarged and edematous and the surrounding area was infiltrated with blood. Two Penrose drains

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were placed and brought out through a stab wound in the left flank. Figure 4 shows the serum amylase readings.*

Case 5.—A male, age 32, was injured by a severe blow in the upper portion of the abdomen. Signs indicating serious intra-abdominal injury developed while he was being observed during the subsequent eight hours. The abdomen was explored through an upper left rectus incision. Figure 5 illustrates the findings. A laceration, five centimeters in

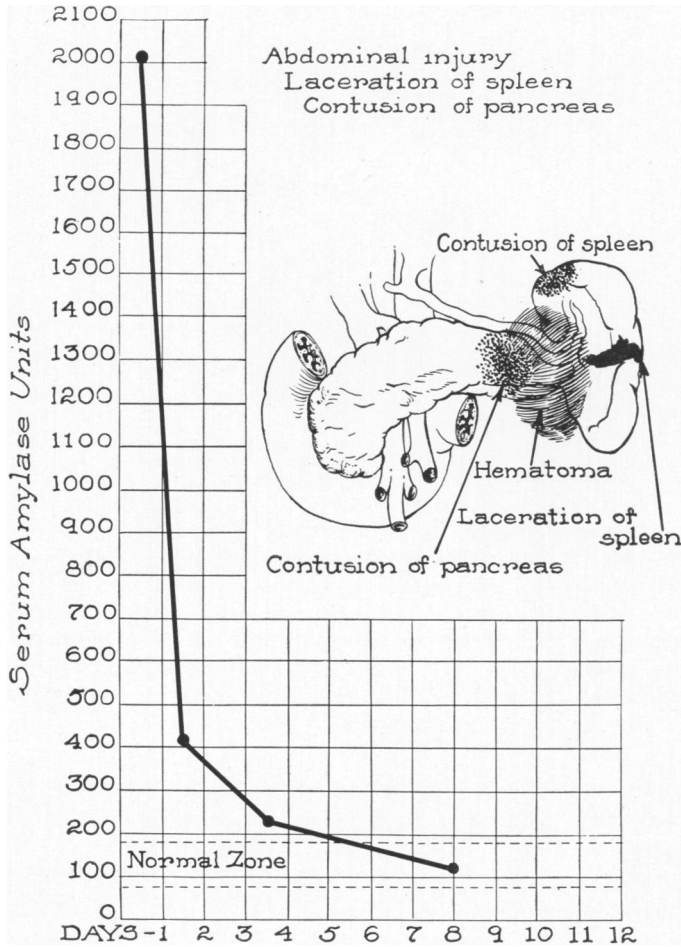


FIG. 4.—Case 4: A sharp rise and fall in the serum amylase level was associated with a contusion of the pancreas by nonpenetrating injury to the abdomen.

length, was found in the third portion of the duodenum and was closed with silk sutures. The peritoneal cavity contained bile-stained fluid and the transverse mesocolon was contused and was infiltrated with the same fluid. No determinations were made before operation, but the serum amylase was 282.5 units on the fourth postoperative day.

Case 6.—A male, age 42, was injured when the bus in which he was riding capsized. He complained of abdominal pain and signs of shock were present. There

* This case was reported in a previous article on the significance of serum amylase test in the diagnosis of acute pancreatitis.

was widespread contusion of the right upper portion of the abdominal wall. The abdomen became progressively more tender and spastic. Extensive pneumoperitoneum and subcutaneous emphysema were present. The abdomen was explored through a right upper rectus incision. The peritoneal cavity contained blood-stained bile. The first portion of the duodenum and the pyloric end of the stomach were irreparably lacerated and contused. The upper margin of the head of the pancreas was contused. Resection of the lacerated duodenum and stomach was carried out, the duodenal stump was inverted and antecolic gastrojejunostomy was performed. The serum amylase readings are shown in Figure 6.

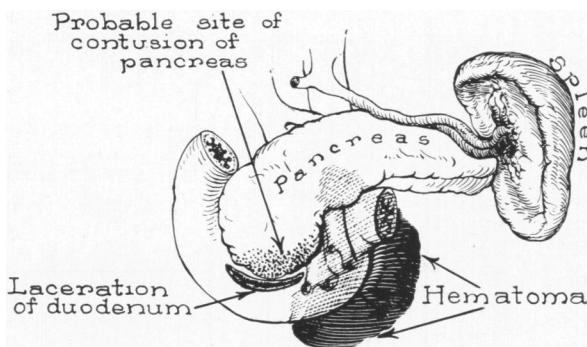


FIG. 5.—Case 5: An increase in the serum amylase was associated with laceration of the duodenum and contusion of the pancreas in this case of nonpenetrating injury of the abdomen.

Case 7.—A female, age 24, fell to the street from a height of about 60 feet. She was in a state of shock. The anterior thoracic wall was deeply contused and a fracture of the forearm and signs of serious intra-abdominal injury were present. She was treated for shock. Celiotomy showed contusion of the left kidney, multiple lacerations and contusions of the spleen and severe contusion of the terminal two inches of the tail of the pancreas (Fig. 7). Splenectomy was performed. The serum amylase before operation was 215 units. A few hours after operation it was 633 units and the following day the reading was 523 units.

The serum amylase was found to be elevated in two instances in which operation was performed upon the pancreas (Cases 8 and 9).

Case 8.—A male, age 47, complained of epigastric pain and jaundice of two months' duration. Complete obstruction of the biliary tract was present. At celiotomy, a small carcinoma of the head of the pancreas was found. The head of the pancreas with part of the body was resected, the pancreatic duct was ligated and the stump of the remaining pancreas was approximated with sutures. The area was drained. The serum amylase was 310 units following operation (Fig. 8).

Case 9.—A male, age 53, complained of vomiting and icterus, without pain, of seven weeks' duration. The biliary tract was obstructed completely. A small carcinoma of the head of the pancreas was found at operation; resection of the head and part of the body of the pancreas was performed. The stump of the enlarged pancreatic duct was ligated and the divided end of the pancreas was approximated with sutures. On the day following operation the serum amylase rose to 382 units (Fig. 9) but promptly fell again. A pancreatic fistula developed on the ninth postoperative day and, at this time, a reading of 755 units was obtained (Fig. 9).

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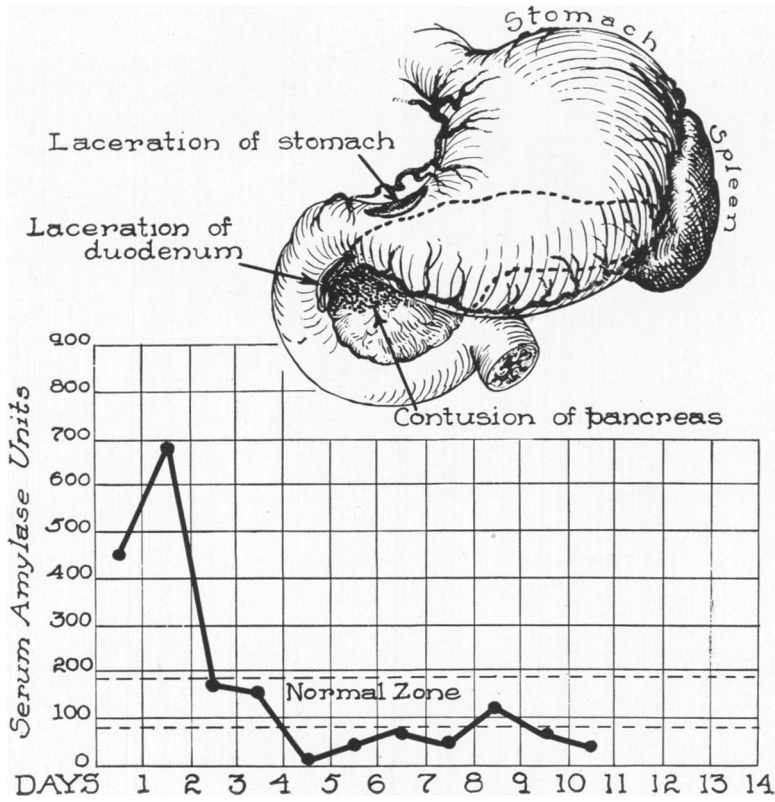


FIG. 6.—Case 6: A sharp rise and fall of serum amylase was followed by a depression of the amylase below the normal level in a case of contusion of the pancreas caused by a nonpenetrating injury of the abdomen. The duodenum and the stomach were also injured.

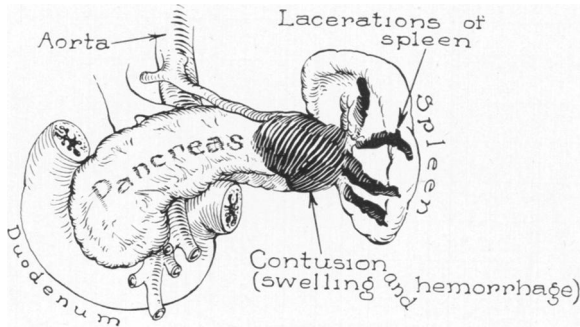


FIG. 7.—Case 7: An increase in serum amylase was associated with contusion of the tail of the pancreas. The spleen was also lacerated by this nonpenetrating injury to the abdomen.

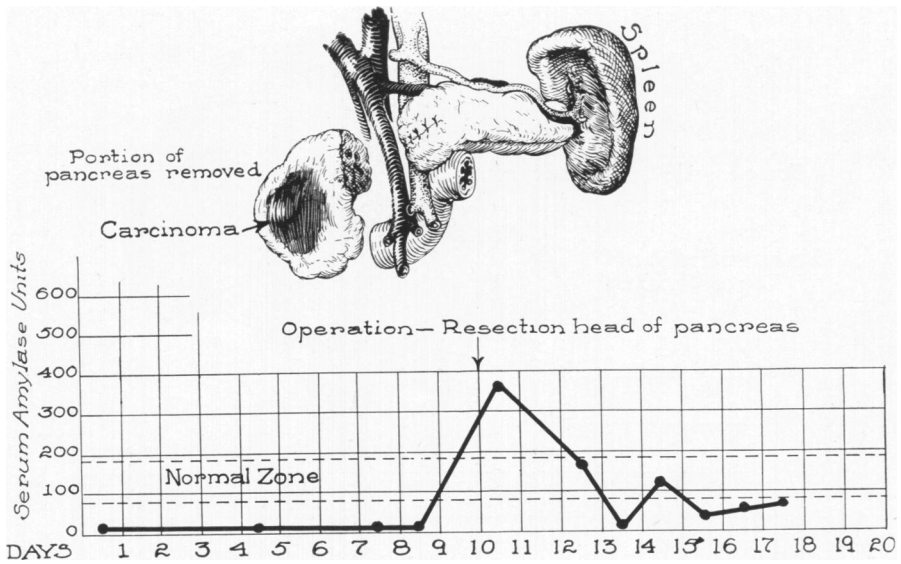


FIG. 8.—Case 8: Temporary elevation of the serum amylase followed resection of the head of the pancreas for carcinoma.

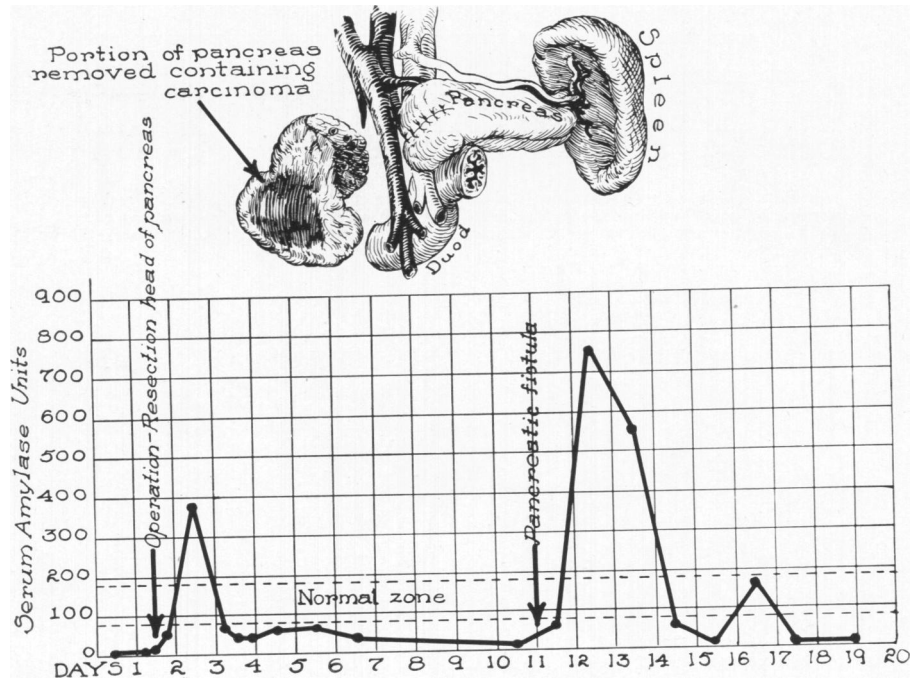


FIG. 9.—Case 9: A transient rise of serum amylase followed resection of the head of the pancreas for carcinoma. A pancreatic fistula developed on the ninth day after operation and this was associated with a secondary rise in the serum amylase.

Rarely, injury to the pancreas may occur during operations for ulcerative diseases of the stomach or duodenum when these organs must be dissected from the pancreas. Also, the pancreas may be traumatized during other difficult operations on the duodenum or lower end of the common duct. No case illustrative of this type of injury is available, however, in which a sufficient number of serial amylase determinations was done to be conclusive.

In a patient who has received an injury to the abdominal region, an elevation in the serum amylase may be considered to be good evidence that the pancreas has been damaged. In most cases there is a rapid rise and fall of the serum amylase following pancreatic injury (Figs. 1, 4 and 6), probably corresponding to the period during which enzymes leak from the injured pancreas. Obviously, it is advantageous to be able to detect evidence of trauma to the pancreas before undertaking an operation for serious injury to the abdomen. In such cases an elevated serum amylase indicates to the surgeon that the region of the pancreas should be examined carefully. When objective evidence of intra-abdominal injury is absent or uncertain, an increase in the serum amylase level occasionally may be the earliest sign of injury to the pancreas.

Lacerations of the pancreas, stab wounds and tearing injuries for example, may be closed with nonabsorbable sutures such as silk or cotton. Contused lacerations such as those received with gunshot wounds and contusions from blunt or nonpenetrating injuries usually cannot be closed. Soft rubber-tissue drains should be placed adjacent to the injured pancreas, and often these drains may be brought to the surface of the body through a small separate incision in the flank. The value of drainage in these cases is not established fully but it probably does no harm and possibly is of some efficiency in preventing diffuse peritonitis or the formation of pancreatic pseudocyst following injury to the pancreas. In some cases pancreatic fistula forms as a result of injury to the pancreas. The skin surrounding the drains should be protected well against possible corrosive action of enzymes.

Because feeding stimulates the secretion of pancreatic juice, food should be withheld and supportive measures maintained for several days in cases in which injury to the pancreas is known or suspected. This is particularly desirable if the serum amylase level remains elevated or fluctuates, or if secondary elevations of the serum amylase occur (Figs. 3 and 9). It is probably safest to assume that such postoperative alterations in the serum amylase indicate a continuation or a recurrence of leakage of enzymes from the injured pancreas. In patients who show evidence of progressive pancreatic necrosis following injury to the pancreas, drainage of the gallbladder or common duct may be considered, but the efficacy of such a procedure has not been demonstrated. This operation was not performed in any of the cases reported here. Drugs, such as atropine, that inhibit pancreatic secretion were not given in these cases but it is possible that they might be useful.

The significance of elevations in the serum amylase occurring after oper-

ations on the pancreas, stomach, duodenum, or lower end of the common duct is probably the same as that of any other trauma to the pancreas. In such cases the principles governing the surgical and postoperative management are essentially the same as those described for cases of injury to the pancreas from external sources.

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DR. ROBERT ELMAN (St. Louis, Mo.): I would simply like to report, briefly, two observations in confirmation of those of Doctors Naffziger and McCorkle, illustrating the sensitivity and rapidity with which the serum amylase test reflects obstruction or injury to the pancreas.

The first observation was made a number of years ago, while working on pancreatic fistulae, all of the pancreatic juice flowing through a rubber tube to the outside. Many weeks after the operation, when all wounds were healed, the tube was clamped. Within *fifteen minutes* after this obstruction the serum amylase had risen from normal level to about four or five times the normal level and increased to much higher levels afterwards.

The second observation is a clinical one, details of which were furnished to me by Doctor Somogyi. A number of years ago, while studying the amylase content of a great many presumably normal serums, he ran across a specimen that contained a very high level of serum amylase. He found that this specimen was obtained shortly after an abdominal operation and that the amylase value returned to normal the next day. He was interested to know what was found at the operation. He asked the surgeon about the condition of the pancreas. The surgeon said he was sure the pancreas was quite normal because he had palpated and examined it, really vigorously, and, I am sure, massaged the whole organ from head to tail and found nothing abnormal.