Aneurysms of anomalous splenomesenteric trunk: Clinical features and surgical management in two cases

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Aneurysms of the splenic artery that anomalously arise from a splenomesenteric trunk are a rarity. Aneurysmal disease of visceral arteries is found in only 0.2% of the general population. The celiac trunk and superior mesenteric artery (SMA) are involved in less than 10% of all visceral aneurysms. Although rupture seems to occur in 20% to 22% of patients, the related mortality rate can rise as high as 100%. Anomalies of the celiac trunk and SMA, more common than previously claimed, include the splenic artery arising from the SMA, which occurs in only 1% of patients. We present two cases of young patients who had 4-cm aneurysms behind the pancreas that involved an anomalous splenic artery. The first patient required dissection of the entire splenopancreatic bloc through a transverse abdominal incision to excise the aneurysm and repair the SMA. The second patient was treated by the classic approach, through a median incision and by entering the mesenteric root. There do not seem to be reports of similar cases, except for two cases of aneurysms involving the celiomesenteric trunk. The cause of these aneurysms can be attributed to mesenchymal alterations during the embryonic formation of aortic collateral branches. A correct surgical approach to splanchnic aneurysms calls for awareness of potential vascular variations of the arteries and their collateral pathways. (J Vasc Surg 1996;24:687-92.)

Anatomic variations of the visceral arteries, particularly those concerning the celiac trunk and the superior mesenteric artery (SMA), are well known in medical literature.[1-3] The most frequent variations involve an anomalous origin of the cystic artery, a right hepatic artery arising from the SMA, or a left hepatic artery from the left gastric artery. A "complete" celiac trunk (gastro-hepato-lienal trunk) can be found in 84% of human beings (Fig. 1), whereas it appears incomplete in 9% (Fig. 2). A common origin of one or more of the main branches of the celiac trunk and SMA is present in 7% of cases, but in only 1% does the splenic artery arise from the SMA (Fig. 3).

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Aneurysms of visceral arteries are an unusual finding, although they have been reported with increasing frequency in recent years. More than 2800 aneurysms of the splanchnic arteries have been described in the medical literature,[4-11] and their prevalence has been estimated at 0.2% in the general population.[12] Aneurysms that involve the medial and distal tract of the splenic artery account for more than 60% of all visceral aneurysms.[13,14] The hepatic artery is affected in 20%, whereas the celiac trunk is involved in 4.5% and the SMA in 5.5.%. The remaining 10% of these aneurysms include those of the branches of the SMA, of the gastroduodenal and pancreaticoduodenal arteries, and of the inferior mesenteric artery, with each accounting for a small percentage.[9,15,16]

Aneurysms that occur in anomalously arising visceral arteries are very rare. The most interesting type, involving a common celiomesenteric trunk, has been reported only twice in the medical literature.[4,17] We report two rare cases of patients who were found to have an aneurysm involving the origin of the splenic artery that arose anomalously from the SMA

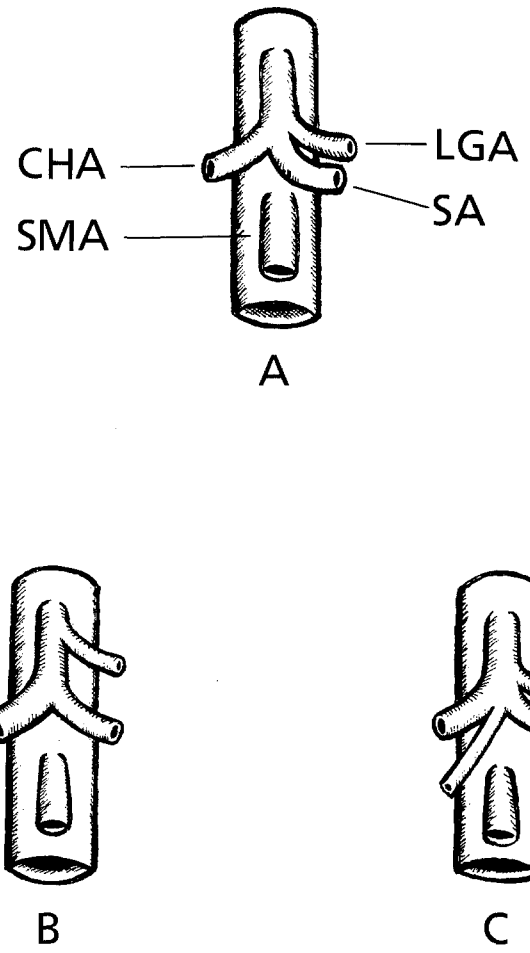

Fig. 1. Complete celiac trunk can be found in 84% of human beings. **A,** Trunk as described in textbooks (tripus Halleri). *CHA,* Common hepatic artery; *LGA,* left gastric artery; *SA,* splenic artery; *SMA,* superior mesenteric artery (~25%). **B,** LGA leaves trunk as collateral artery (~49%). **C,** Celiac trunk presents four main branches (tetrapus), the fourth being additional dorsal pancreatic artery (10%). (Modified from Lippert H, Pabst R. Arterial variations in man. Munich: JF Bergmann Verlag, 1985.)

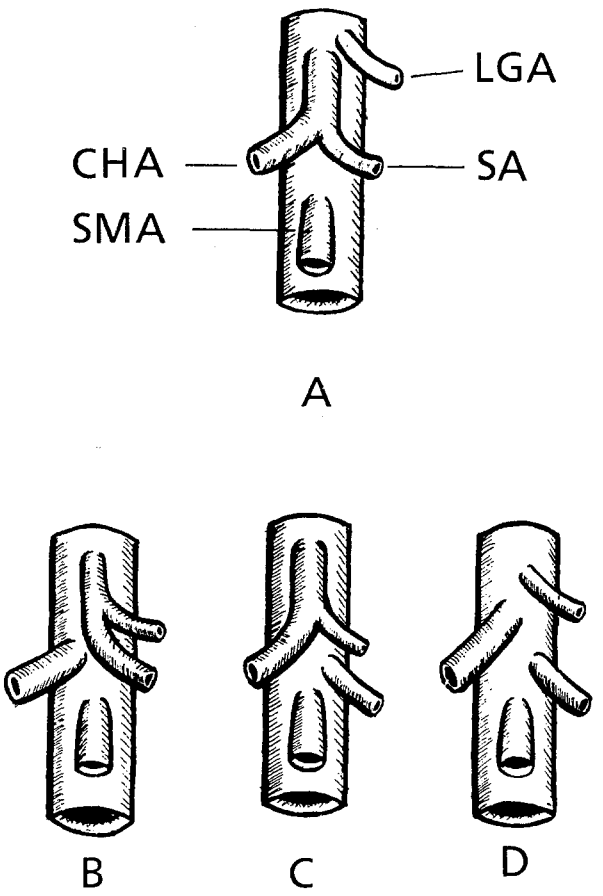

Fig. 2. Incomplete celiac trunk, with different combinations of main branches. *CHA,* Common hepatic artery; *LGA,* left gastric artery; *SA,* splenic artery; *SMA,* superior mesenteric artery. **A,** 5%; **B,** 3%; **C,** 1%; **D,** <1%. (Modified from Lippert H, Pabst R. Arterial variations in man. Munich: JF Bergmann Verlag, 1985.)

just behind the pancreas. Despite a thorough search, we were unable to find any previous description of this entity in the medical literature available today. In this paper we aim to review the developmental pattern of this rare disease and discuss the different surgical approaches that we adopted.

CASE REPORTS

Case 1. A 45-year-old man in Milan, who complained of mild pain at the right hypochondrium, underwent routine ultrasonography of the upper abdomen. The instrumental investigation showed an aneurysm 4 cm in diameter just behind the head of the pancreas, which was suspected to be connected to the aorta. Further examination by computed tomographic (CT) scanning (Fig. 4) confirmed the presence of the aneurysm located at the right side of the aorta and pushing the head of the pancreas forward. A transfemoral abdominal aortographic examination then indicated that the aneurysm involved the origin of the splenic artery, anomalously arising near the root of the SMA (Fig. 5), whereas the left gastric artery and the right hepatic artery arose from a common trunk in the usual site. Furthermore, the aneurysm appeared to be dislocated to the right side of the aorta and imprinting the portal vein.

The patient was referred to our department for surgical treatment. The radiologist excluded any possibility of embolization because of the large size of the aneurysm and the width and shortness of its neck, which could cause distal embolization of the mesenteric artery. Surgery was therefore mandatory.

The abdomen was opened through a bilateral subcostal

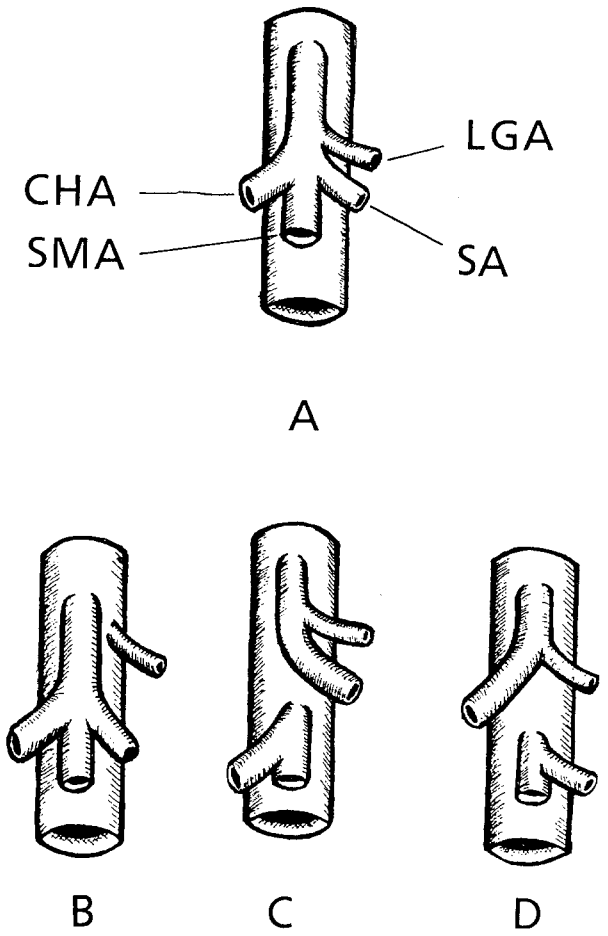

Fig. 3. Common origin of whole celiac trunk or of its main branches with SMA. *CHA,* Common hepatic artery; *LGA,* left gastric artery; *SA,* splenic artery; *SMA,* superior mesenteric artery. **A,** 2%; **B,** 1%; **C,** 3%; **D,** 1%. (Modified from Lippert H, Pabst R. Arterial variations in man. Munich: JF Bergmann Verlag, 1985.)

incision. The anatomic location of the aneurysm was found as shown in Fig. 6, *A,* as was to be expected from the angiographic scan. Precautionary control of the aorta was achieved at the level of the diaphragm. An attempt to reach the aneurysm from the right side was unsuccessful because of its close connections to the portal vein and the common bile duct. After detaching the transverse colon and the left colonic flexure, the lesser sac was opened and the pancreas was reached. A further attempt was made to reach the origin of the SMA by careful cephalad and caudad dissection of the pancreatic body. These maneuvers could have led to the control of the origin of the SMA, but not of the aneurysm itself. The only feasible approach was to mobilize the entire splenopancreatic bloc from left to right (Fig. 6, *B*). By doing this, it was possible to observe that the splenic artery ran partially in a groove along the back of the pancreas. The origin of the SMA then was easily reached, and further

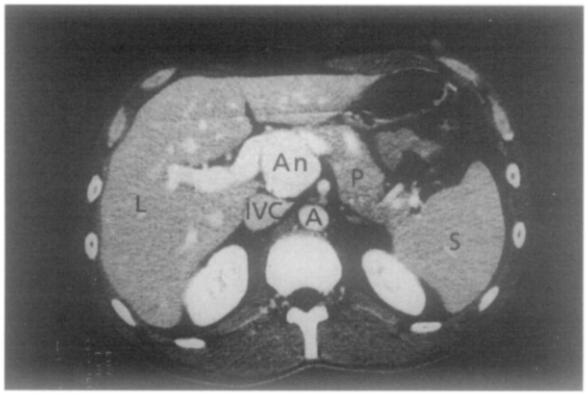

Fig. 4. Case 1. Transverse CT scan shows aneurysm behind pancreas. *L,* Liver; *S,* spleen; *P,* pancreas; *A,* aorta; *IVC,* inferior vena cava; *An,* aneurysm.

dissection allowed the exposure of the neck of the aneurysm, of the distal SMA, and of the splenic artery exiting from the sac. The arteries were clamped after systemic heparinization, and the neck of the aneurysm was transected. The opening in the SMA was closed with a running suture of 5/0 polypropylene and the clamps were released, with good pulsation of the reconstructed vessel. The splenic artery was ligated because removal from the pancreas with consequent reimplantation was not feasible. The spleen appeared grayish and was therefore removed.

During the postoperative course, the patient had increased serum amylase and lipase levels without any clinical sign of pancreatitis. A control CT scan revealed a normal parenchyma. Histologic examination of the aneurysmatic wall showed medial degeneration. The patient was discharged after 20 days; he has returned to his previous job and is doing well after 1 year. He still takes 0.3 g acetylsalicylic acid daily because of the high level of platelets (around 500,000) that was a consequence of the splenectomy.

Case 2. A 43-year-old woman in Marseilles sought medical attention because of epigastric pain. Results of gastroscopy were normal. Ultrasonography of the upper abdomen showed a round-shaped pulsatile area located between the pancreas and the aorta, with a diameter of approximately 3.5 cm. Further CT examination (Fig. 7) corroborated the good condition of the aorta and defined the presence of an aneurysm 2.8 × 3.2 cm, which could have developed from the splenic artery or the SMA. The other organs were normal.

Subsequent aortography (Fig. 8, *A*) showed an aneurysm in front of the aorta and the hepatic artery arising directly from the aorta. The lateral view showed that the SMA and the splenic artery both emerged from a common trunk. Selective dye injection into this trunk (Fig. 8, *B*) showed that the aneurysm had developed in front of its bifurcation. The decision to operate was made. The abdomen was opened through a median laparotomy. Control of the celiac aorta was achieved after sectioning the right pillar

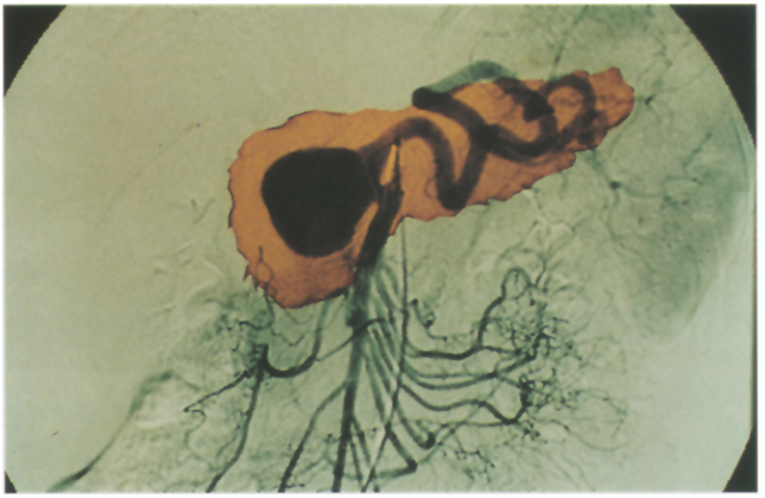

Fig. 5. Case 1. Selective dye injection into SMA shows aneurysm involving splenic artery just after its anomalous origin. *Yellow drawing* represents relationship with pancreatic head.

of the diaphragm and opening the small omentum. At this stage, the root of the transverse mesocolon was cut to look for the origin of the common trunk (mesenteric and splenic). The SMA then was reached, and the aneurysm was found by following the path of the artery and by slightly retracting the pancreatic body upwards. After systemic heparinization the vessels were clamped and the aneurysmatic sac opened. The pedicle was well marked; thus it was possible to suture its origin while maintaining the patency both of the SMA and of the splenic artery. Histologic examination of the aneurysmatic wall showed atherosclerotic changes. The patient's postoperative course was uneventful and without any pancreatic disorder. At control arteriography, performed before discharge, the presence of a common trunk was confirmed with a regular bifurcation into the SMA and the splenic artery. The patient is well 1 year after discharge.

DISCUSSION

Aneurysms of splanchnic arteries are mostly a chance finding during laboratory investigations performed for various clinical disturbances.[6,18] This finding, however, has become more frequent since abdominal ultrasonography has routinely been performed for all signs and symptoms referring to the upper abdomen. Otherwise the diagnosis is made during emergency laparotomies for acute bleeding caused by rupture of the aneurysm.[4,9,18] Symptoms can appear if the aneurysm compresses neighboring structures, like the common bile duct, which causes jaundice.[19] Visceral aneurysms are often small and rarely exceed a diameter of 5 or 6 cm.[9] The causes of visceral aneurysms include atherosclerosis, medial degeneration, infection, fibromuscular dysplasia, and congenital anomalies.[4,9,18,20] There is a definite prevalence in women,[17] especially in the case of aneurysms of the splenic artery. In our patients, neither of whom had any sign of systemic vascular disease, a congenital alteration could have been assumed as the primary cause of aneurysmatic degeneration of the artery, probably resulting from a mesenchymal anomaly during fetal development.

During embryonic development[1,17] three groups of collateral arteries arise from the abdominal aorta: (1) the dorsal branches, the future lumbar arteries: (2) the lateral branches that carry the blood supply to the kidneys, adrenal glands, and genital organs; and (3) the ventral branches that develop initially as paired vessels and then coalesce on the median line to form the four roots for the gut. These four roots are initially separated and connected by ventral longitudinal anastomoses. In the majority of cases, the first root (gastric), the second (hepatic), and the third (splenic) coalesce to form the celiac trunk, whereas the fourth develops into the SMA and is led caudally by the ventral migration of the gut. It can easily be argued from this description that any slight alteration both of median coalescence and interruption of the ventral anastomoses during the embryonic development may produce a vast variety of vascular anomalies that involve the celiac trunk and the SMA. The splenic artery is thought to arise anomalously from the SMA in only 1% of patients.[1]

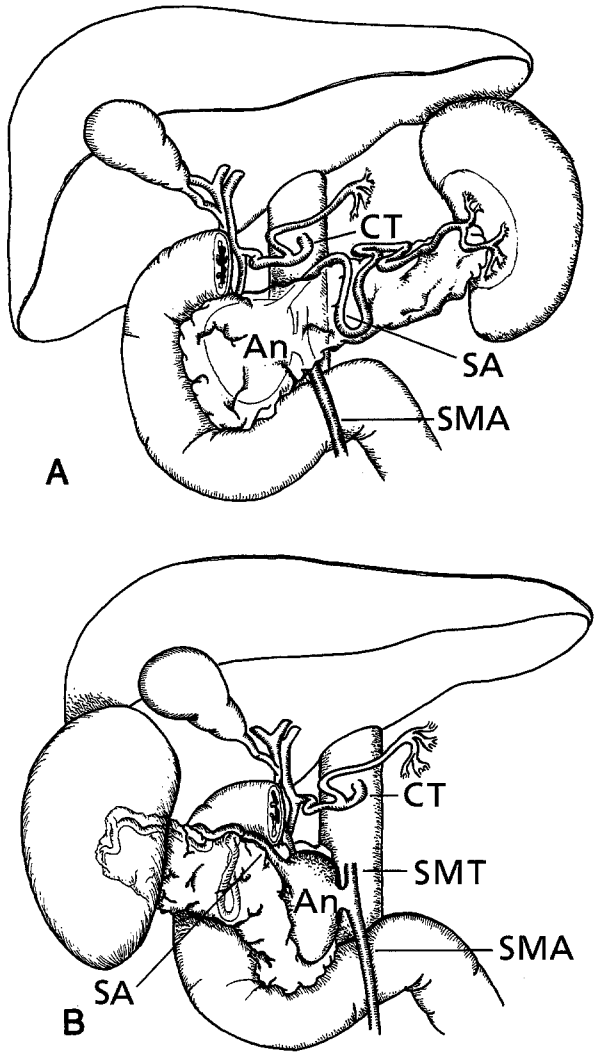

Fig. 6. Case 1. **A,** Artist's drawing of region as found at operation. *CT,* Celiac trunk, composed of LGA and CHA; *SA,* splenic artery; *SMA,* superior mesenteric artery; *An,* aneurysm. **B,** Artist's drawing of mobilization of entire splenopancreatic bloc. *CT,* Celiac trunk, composed of LGA and CHA; *SA,* splenic artery; *SMA,* superior mesenteric artery; *SMT,* splenomesenteric trunk; *An,* aneurysm.

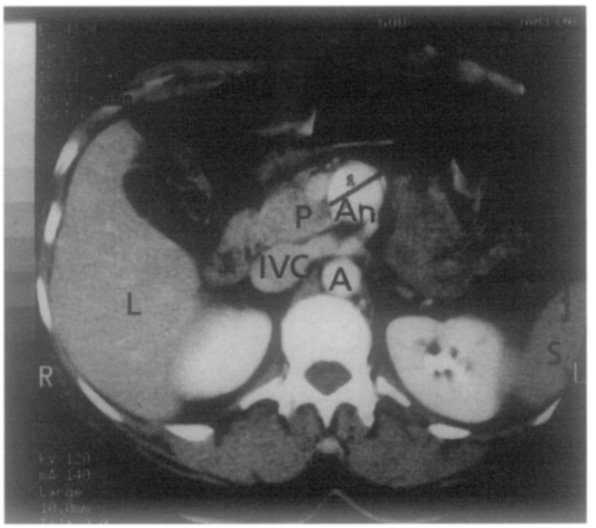

Fig. 7. Case 2. Transverse CT scan shows location of aneurysm behind pancreatic body. *L,* Liver; *S,* spleen; *P,* pancreas; *A,* aorta; *IVC,* inferior vena cava; *An,* aneurysm.

The mortality rate after rupture of a splanchnic aneurysm ranges from 35% to 100% as a result of the often catastrophic hemorrhages that may ensue, whereas the elective operative mortality rate is less than 10%.[4,9,16-18] Because it is impossible to predict which aneurysms will rupture, surgical treatment is mandatory in almost all patients. In small-size aneurysms involving gastroduodenal or pancreaticoduodenal arteries, a simple ligation may be sufficient because of the vast collateral circulation. Otherwise, especially in aneurysms that affect the hepatic artery, it is advisable to restore vascular continuity to avoid ischemic damage to the liver.[19] In our patients the risk of rupture was thought to be high because of the large size of the aneurysms. Moreover, possible rupture could have been catastrophic because of the aneurysm's unusual site. We were not dealing with a classic aneurysm of the SMA, for which the surgical approach is well codified.[20,21] In other similar cases,[12,17] control of the neck of the aneurysm was achieved by a cephalad dissection along the aorta. In those cases, however, a common celiomesenteric trunk was present whose anatomical location was probably closer to that of the "normal" celiac trunk (which migrates from C7 to T12), some centimeters cranially with respect to the final location of the SMA (from T3 to L3). An anomalous origin of the splenic artery from the SMA can be carried downwards by the caudal migration of the SMA, behind the head of the pancreas. This possibility led us to select the approach described above in the first case as the only viable one. In the second case, the aneurysm had developed just in front of the bifurcation of the common trunk, so it was possible to follow the classic route by entering the mesenteric root and excising the aneurysm at its neck. Thus the patency of the splenic artery was preserved.

CONCLUSION

Aneurysms of visceral arteries have a high risk of rupture. When they are identified, surgery is manda-

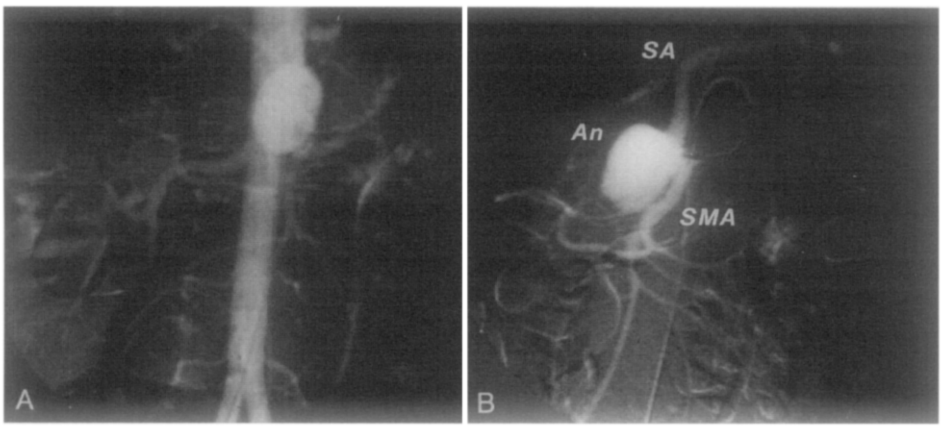

Fig. 8. Case 2. **A,** Transfemoral aortography shows aneurysm in front of celiac aorta. **B,** Selective dye injection into SMA shows aneurysm developing in front of common (splenomesenteric) trunk's bifurcation. *SA,* Splenic artery; *SMA,* superior mesenteric artery; *An,* aneurysm.

tory. The size and anatomic location of the aneurysms should be considered to determine the correct surgical treatment. In fact, surgical management sometimes can be difficult because of a particular anatomic location, such as close to the common bile duct and portal vein or behind the pancreas. Moreover, the surgeon cannot forget that arterial variations (more frequent than claimed before) may call for a sudden change of the planned surgical approach. In such cases a perfect knowledge of the anatomy of the region is essential if the best exposure of the affected arteries is to be achieved.

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