

Casuistics

Diagnostic postmortem angiography of fatal splenic artery haemorrhage

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Summary. The site of fatal haemorrhage from the splenic artery, caused in one case by a ruptured aneurysm and in another case by an intracystic haemorrhage of a postoperative pancreatic pseudocyst, was revealed by postmortem angiography. Radiopaque silicone rubber vulcanizing at room temperature was used as contrast medium. In the latter case, the dissection was seriously hampered by tight postoperative intestinal adhesions following four abdominal operations to control bleeding into the gastrointestinal tract. The results indicate the usefulness of postmortem angiography with contrast medium vulcanizing at room temperature for postmortem diagnosis of rare causes of gastrointestinal haemorrhage.

Key words: Postmortem angiography – Haemorrhage from splenic artery

Zusammenfassung. Die Quelle der tödlichen Blutung der Arteria lienalis, die in einem Fall durch die Ruptur eines Aneurysma und im anderen Fall durch die Verblutung in die Pseudozyste des Pankreas nach der Operation veranlaßt war, wurde mit Hilfe der Angiographie bei der Leichenöffnung dargestellt. Bleioxid in Siliconkautschuk Vergußmasse (Wacker-Chemie GmbH.) wurde als Kontrastmittel bei Zimmertemperatur angewandt. Im zweiten Fall war die Dissektion wegen der festen Adhäsionen nach vier Magenoperationen, die man wegen der Blutungen ausgeführt hatte, sehr schwierig.

Die Ergebnisse weisen darauf hin, daß bei der Obduktion die Verwendung dieser angiographischen Methode, mit bei Zimmertemperatur vulkanisierbarem Material, gut geeignet ist für den Nachweis von seltenen und mit anderen Methoden nur schwierig darstellbaren Blutungsquellen in die Bauchhöhle oder den Magendarmkanal.

Schlüsselwörter: Postmortale Angiographie – Blutung aus der A. lienalis – Aneurysma-Ruptur, Verblutung

Introduction

The splenic artery, one of the main branches of the coeliac artery, is not usually explored at autopsy. Sudden death caused by a haemorrhage from the splenic artery most commonly occurs as the result of a ruptured aneurysm of the splenic artery [1]. Rupture or intracystic haemorrhage from the splenic artery into a pancreatic pseudocyst is another rare cause of acute massive gastrointestinal bleeding [2]. A pancreatic pseudocyst most commonly follows acute pancreatitis, trauma to the pancreas or pancreatic surgery [3].

At autopsy, the usual method for determining the source of bleeding from splanchnic arteries is to dissect the suspected artery carefully from its proximal undamaged portion [4]. However, splanchnic arteries show considerable anatomic variation and a complicated three-dimensional structure. It may therefore be difficult to identify the location of a rupture in the haemorrhagic and swollen tissue. An alternative approach is to perform angiography of the coeliac and mesenteric arteries [5, 6]. However, despite its clear advantages, postmortem angiography has seldom been applied in the diagnosis of massive gastrointestinal haemorrhage at autopsy [6, 7].

In the present paper we describe the value of postmortem angiography with a contrast medium vulcanizing at room temperature to diagnose acute rupture of the splenic artery at autopsy.

Patients and Methods

In the Department of Forensic Medicine at the University of Helsinki, postmortem angiography has been used routinely as a diagnostic tool. Among the more than 300 angiographies there were two cases with haemorrhage originating from the splenic artery. The postmortem angiographic method with radiopaque silicone rubber vulcanizing at room temperature (RTV silicone rubber) as contrast medium has been described in detail elsewhere [7].

Case Reports

Case 1. A 69-year-old woman collapsed after an episode of severe upper abdominal pain and was initially treated for a myocardial infarct at the local hospital. She suddenly became hypotonic, and haemoglobin decreased to 69 g/l. An emergency gastroscopy was performed, with negative results. Dissection of the aorta or traumatic rupture of the spleen was then considered, but bradycardia supervened and the patient died.

At autopsy the liver was found to be polycystic, weighing 2100 g. There were two small cysts on the outer surface of the kidneys, but they were otherwise normal. There were no signs of portal hypertension, and the spleen weighed 150 g. The peritoneal cavity contained 2000 ml blood and blood clots. A haematoma was found behind the greater curvature of the ventricle near the hilus of the spleen. Water injected into the splenic artery distended a 3-cm tumour-like lesion at the tail of the pancreas. An angiography was performed manually from the coeliac artery with RTV silicone rubber (Silikon Kautschuk RTV-Vergußmasse K, Wacker Chemie, Munich, FRG) made radiopaque with 20% of lead oxide as a contrast medium [7, 8].

Case 2. A 44-year-old alcoholic man with a history of several periods of pancreatitis was taken to hospital because of sudden massive haematemesis. An emergency operation revealed diffuse mucosal bleeding, and the ventricle was immediately resected, followed by a splenectomy. The abdominal cavity was recanalized because of continuous bleeding from the drains

and a postoperative abscess in the area of the resected ventricle stump. Owing to profuse bleeding, a left thoracotomy with oesophagostomy, exploration of the oesophagus and truncal vagotomy were performed 3 weeks after the initial operation. However, 4 days later the patient again developed profuse bleeding, and a relaparotomy and left rethoracotomy were performed. In this operation, a total gastrectomy and oesophago-jejunal reconstruction with a Roux Y were performed. One week postoperatively he started bleeding into the gastrointestinal canal. Abdominal angiography did not reveal the cause of several periods of massive haematemesis. Leakage from the suture line of the gastrectomy was observed on a gastric X-ray taken with contrast medium. The patient died of massive haematemesis 43 days after the primary operation.

At autopsy, tight adhesions were found in the intestine, which could not be separated. The thoracic organs were removed in the normal manner, and the abdominal aorta was transected at the level of the diaphragm. Both iliac arteries were clamped. The abdominal viscera was removed en bloc, and the coeliac and superior mesenteric arteries were cannulated with a mouthpiece and perfused at the autopsy table with the silicone rubber contrast medium at 120 mm Hg for 30 min, using a portable perfusion device with quick couplings to the compressed air line [7]. To remove air bubbles, a needle was inserted in the uppermost part of the cannulated aorta.

Radiography

After the perfusion was completed, radiographs were taken immediately using a distance of 100 cm, 55 kV and 300 mAs. In the latter case, two radiographs were taken at a 5° angle to obtain stereopair radiographs. A conventional Siemens fullwave X-ray machine is used with Agfa-Gevaert Scopix CR3B film.

Cast

The vulcanizing of liquid silicone rubber was commenced by adding 2% of catalyst (Haerter T) to the perfusion medium. The mixture was converted into a flexible rubber cast within 2 h. The tensile strength of the vulcanized mass is $2.0 \pm 0.3 \text{ N/mm}^3$ and the elasticity, $130 \pm 20\%$.



Fig. 1. Postmortem angiography of a ruptured aneurysm in a tortuous splenic artery of a 69-year-old woman (case 1). The site of the rupture is indicated by a probe

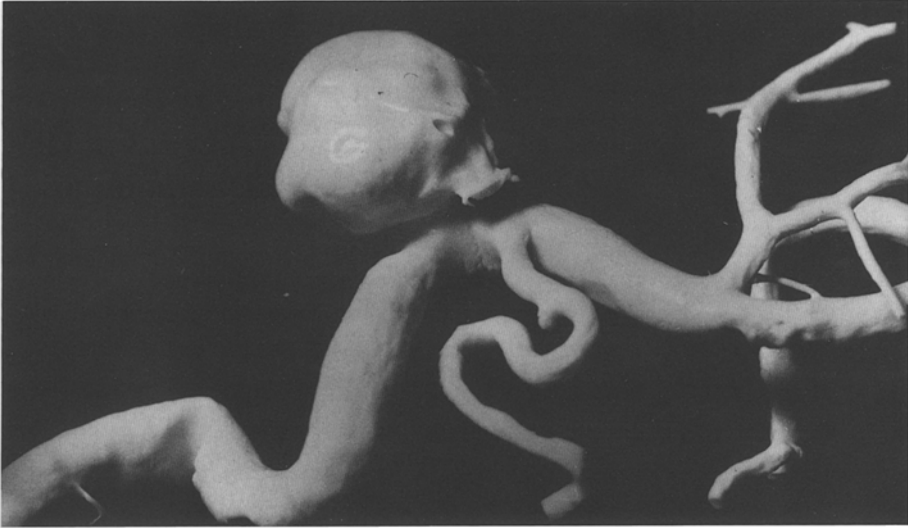


Fig. 2. A rubber cast from the ruptured aneurysm of the splenic artery. The rupture site is visible in the front wall of the aneurysm

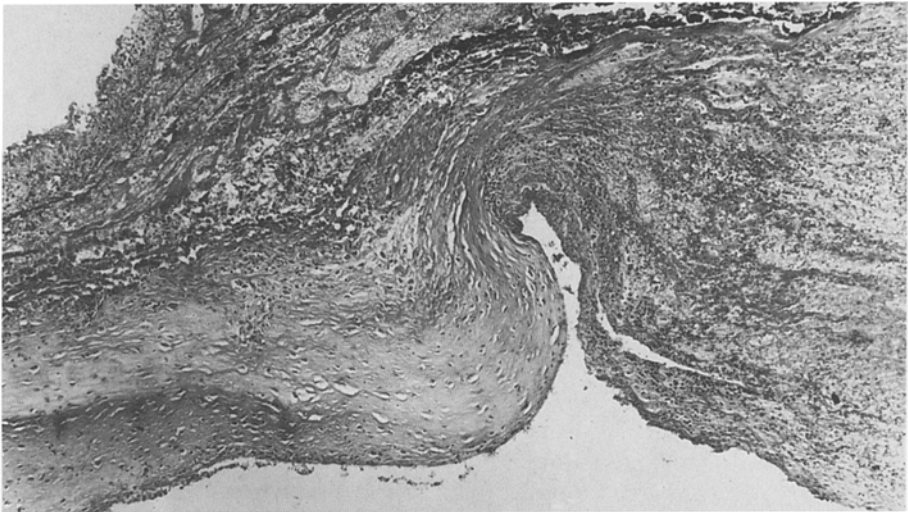
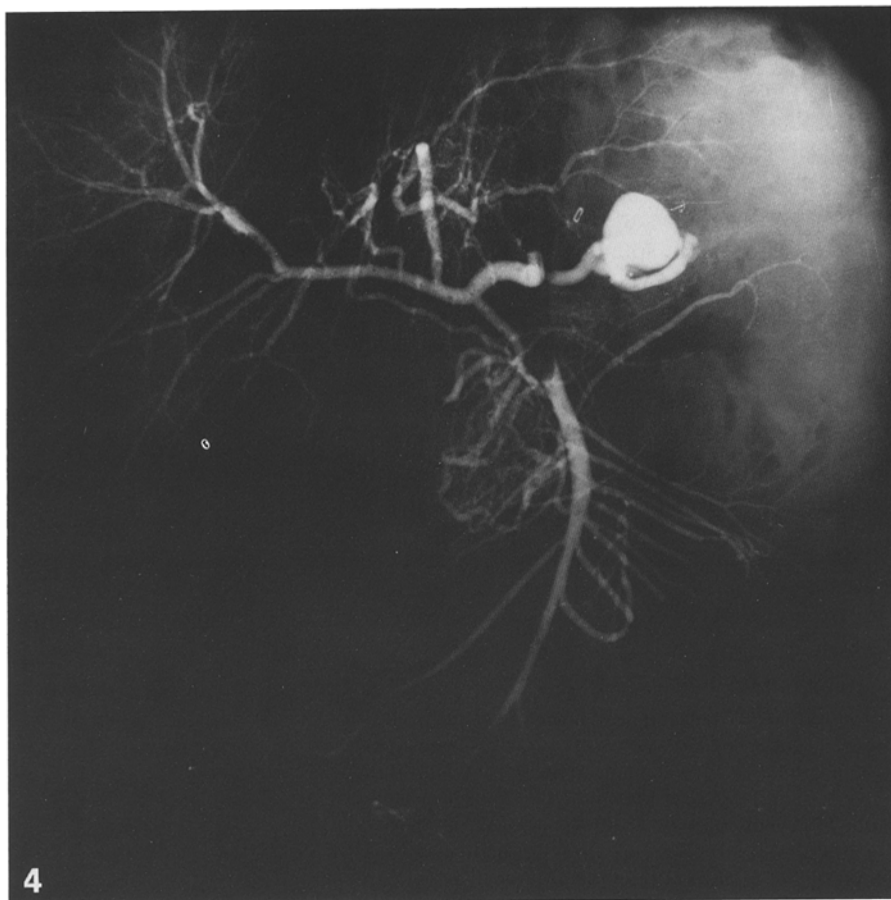


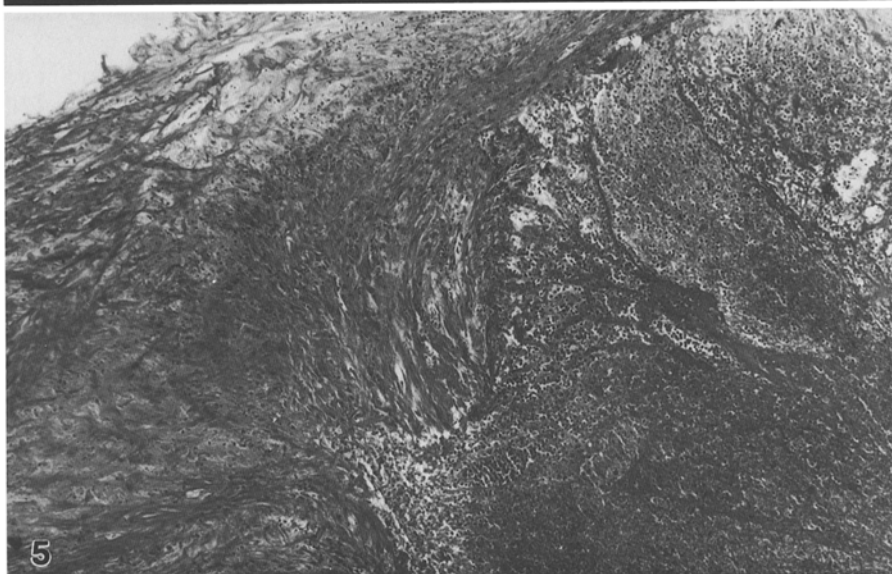
Fig. 3. The rupture site in the wall of the splenic artery aneurysm, with thrombus attached. The epithelium and the normal artery wall are seen on the left

Fig. 4. Postmortem selective angiography of the coeliac and superior mesenteric artery of a 44-year-old man (case 2), demonstrating a pancreatic pseudocyst at the side of the splenic artery. The spleen has been removed

Fig. 5. Haemorrhage into the ruptured pancreatic pseudocyst. The wall of the pseudocyst has no true epithelial lining but is composed of granulation tissue



4



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Results

The rupture of the splenic artery was clearly demonstrated in both cases. In the first case, the angiography revealed a calcified splenic artery aneurysm of 3 cm. The contrast medium had leaked into the peritoneal cavity from a 3-mm rupture (Figs. 1, 3). The firm rubber cast with aneurysm could be pulled out from the splenic artery (Fig. 2).

In the second case, an oval leak of contrast medium was detected at 4 cm from the origin of the splenic artery (Fig. 4). A false cyst containing an onion-like structure composed of several layers of organizing sheets of older haemorrhage was found surrounding the oval silicone rubber mass. The wall of the cyst was composed of granulation tissue (Fig. 5). The suture line at the lower end of the oesophagus was ruptured, and there were several recent and older haemorrhagic areas in the pancreas, together with inflammatory fibrosis.

Discussion

Aneurysm of the splenic artery is the most common of the rare splanchnic artery aneurysms, which account for approximately 3% of all aneurysms. More than 900 cases, mainly of ruptured splenic artery aneurysms, have been reported [1, 9]. However, the true incidence of splenic artery aneurysms is unknown, since most patients are asymptomatic and the diagnosis is made incidentally. The incidence found at autopsy studies varies considerably, from 0.01% to 10.4% [4]. Aneurysms of the splenic artery have been found in 20%–50% of patients with liver cirrhosis or portal hypertension [10, 11]. In our first case the liver was polycystic but there were no signs of portal hypertension, such as splenomegaly. The risk of rupture of the aneurysm of the splenic artery is considered low [12]. It is not unusual for the bleeding to be contained within the lesser sac, allowing temporary stabilization of haemodynamics during the initial phase. If untreated, fatal rupture into the peritoneal cavity eventually occurs minutes to hours later.

Pancreatic pseudocyst is formed by encapsulation of extravasated blood and pancreatic fluid in the peripancreatic tissue or in the lesser peritoneal sac [3]. The pseudocyst develops over a period of 1–4 weeks and is preceded by pancreatitis in 75%–90% of cases and trauma in 10%–25% [13]. Infrequently, cysts may form following abdominal surgery [3]. Cysts may be small (2 cm in diameter) or large (almost the size of a football). Up to 85% of such cysts may subside spontaneously [3]. The cystic spaces usually communicate with one of the major pancreatic ducts. Haemorrhage is a particularly grave but rare complication of pseudocysts [2], and is usually into the gastrointestinal tract or directly into the peritoneal cavity. In our case 2, leakage from the ventricle suture had probably caused postoperative pancreatic inflammation with resulting formation of a pseudocyst. Intracystic haemorrhage had converted the pseudocyst into a pseudoaneurysm communicating with the gastrointestinal tract via the leakage in the suture line at the lower end of the oesophagus. There were several layers of organizing haematoma around the solidified silicone rubber cast; these corresponded to the periods of clinically observed haematemesis. The tight postoperative intestinal adhesions might have prevented haemorrhage in

the intraperitoneal space. The source of bleeding would thus have been missed at post mortem because of technical problems stemming from the severe adhesions of the abdominal viscera.

In patients attending clinics, the diagnosis of splenic artery aneurysm is often indicated by the presence of curvilinear calcification in the left upper quadrant on an abdominal radiograph, but it can only be definitively confirmed by means of angiography. Pancreatic pseudocyst is most reliably visualized by sonography or computerized tomography, though some portion of the gastrointestinal tract may be found to be displaced on X-ray examination or angiography [13, 14].

In our experience, angiography has many advantages as a postmortem diagnostic procedure and should be performed before dissection of the arteries if the technical facilities are available. In contrast, Bedforde and Lodge [4] found no cases of splenic artery aneurysm not already revealed by dissection only. However, their method included removal of the spleen and pancreas en bloc, with subsequent complete dissection of the splenic artery. The reason for the limited use of postmortem angiography might arise from difficulties in applying the laborious techniques and perfusion equipments usually intended for laboratory use to the performance of autopsies [6]. Our angiographic method is simple. The perfusion device is transportable and applies quick couplings. There is no need to pre-perfuse the arteries with saline [7, 15]. The suspected artery can be injected selectively or, if the abdominal aorta is cannulated, all splanchnic arteries can be visualized at the same time.

The second problem may arise with the contrast medium. Barium sulphate is commonly used [6], but does not tolerate dissection after the angiography. It leaks readily during injection, thus ruining the possibility of diagnosis. Warming and cooling is the prerequisite for solidifying of either barium sulphate/gelatin mixture or vinyl acetate [6, 10]. We used RTV silicone rubber made radiopaque with 20% lead oxide and infused for angiography at physiological pressure [7, 15]. The high viscosity of the liquid silicone mass excludes the possibility of peaks in the perfusion pressure during injection, a danger mentioned by Hübner and Boehm [16]. The method provides permanent documentation in the form of the rubber cast. Previously, Manenti and Williams [10] used RTV latex dispersion for injection studies of the splenic vasculature. They preferred rubbery latex to vinyl acetate, which is also used for the same purposes [6].

In conclusion, the present results suggest that postmortem angiography should be applied for diagnosis in all cases with massive gastrointestinal catastrophes when an autopsy is performed. Rare causes of haemorrhage, such as splenic artery rupture caused by aneurysm or postoperative pancreatic pseudocyst, are difficult to reveal by means of conventional dissection only.

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