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Ultrasonic-Guided Percutaneous Injection of Pancreatic Pseudoaneurysm with Thrombin

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Abstract

Pancreatic pseudoaneurysm is a relatively uncommon complication of chronic pancreatitis, with an associated high mortality if rupture or hemorrhage occurs. We present a case of pancreatic pseudoaneurysm complicating pancreatitis which was successfully treated by direct percutaneous injection of thrombin into the aneurysmal sac. Follow-up at 8 weeks did not demonstrate recurrence. This case indicates that percutaneous thrombin injection offers effective treatment of visceral arterial pseudoaneurysms.

Key words: Pancreatitis—Aneurysm, mesenteric—Aneurysm, therapy

Pancreatic pseudoaneurysm is a relatively uncommon complication of pancreatitis with an estimated incidence of 5–10% in chronic pancreatitis [1]. It is usually but not invariably associated with pseudocyst formation and has potential for life-threatening complications, mainly rupture and bleeding with an associated high mortality. If bleeding is left unattended or treated conservatively mortality is put at more than 90%. A mortality rate of 15–40% has been quoted with emergency surgical treatment [2]; this is dependent on the anatomic location of the pseudoaneurysm (e.g., head carries a greater risk than body or tail due to an increased risk of peri-operative bleeding). Surgical management generally involves proximal and distal arterial ligation or intra-cystic ligation combined with drainage procedures, splenectomy or gastrectomy [3]. Radiological approaches to treatment include coil occlusion of the parent vessel with transcatheter coiling of the pseudoaneurysm sac. Variable success rates of 67–100% have been reported with the technique but it is not without potential serious complications [4, 5]. We present a case of pancreatic pseudoaneurysm, considered to be unsuited to treatment by coiling, which was successfully treated using percutaneous injection of thrombin.

Case Report

A 50-year-old woman was admitted with an acute exacerbation of chronic calcific pancreatitis secondary to alcohol abuse, complicated by pseudocyst formation in the head and tail of the gland. The largest of the pseudocysts was subsequently drained and the patient discharged home. On subsequent clinical review at 6 months, the patient was abstaining from alcohol and asymptomatic. Twenty months later she was readmitted with a 2 week history of abdominal pain of increasing severity. Serum amylase was elevated at 548 IU/l. A diagnosis of acute-on-chronic pancreatitis was made.

She was treated conservatively and serum amylase normalized within 1 week. However, her pain persisted and a CT scan of the abdomen was performed. This demonstrated a pseudoaneurysm of the pancreatic head measuring approximately 3 cm in diameter. There was no evidence of new pseudocyst formation. Selective mesenteric angiography was performed using a 5 Fr sidewinder catheter. This demonstrated the aneurysm arising from the origin of the gastroduodenal artery immediately below the bifurcation of the common hepatic artery (Figs. 1, 2). Venous phase images showed that the portal vein was significantly compressed by the adjacent aneurysm (Fig. 3).

As regards possible treatment options parent vessel occlusion would have required occlusion of the common and proper hepatic arteries. Given the already compromised portal venous flow, this was deemed contraindicated. There was no branch feeding vessel which could be catheterized. Unfavorable angulation of the aneurysm sac precluded direct transarterial catheterization. Percutaneous coil embolization could have been performed but would have resulted in a large and permanent coil mass with potential for future erosion into adjacent structures. Following sterile preparation of the overlying abdominal wall and administration of local anesthesia (lignocaine 1%, 5 ml) 1,000 IU of bovine thrombin (Thrombin-JMI, Gen. Trac., Middleton, WI, USA) in 1 ml of saline was injected into the pseudoaneurysm using a 22 gauge spinal needle under direct ultrasonic guidance (Toshiba Tosbee, curvilinear probe, frequency 3.75 MHz). Immediate results were satisfactory with both ultrasonic and angiographic evidence of thrombosis of the aneurysm, with normal flow in both the gastroduodenal and hepatic arteries (Fig. 4). There were no complications. Repeat ultrasonic examination at 72 hours (GE Logiq 7 curvilinear probe, frequency 4 MHz) confirmed complete thrombosis of the pseudoaneurysm with no evidence of flow within it (Fig. 5). Delayed follow-up at 8 weeks demonstrated a small pseudocyst but no evidence of pseudoaneurysm (Fig. 6). Portal vein and hepatic artery were patent. The patient was well and asymptomatic.

Discussion

Pseudoaneurysm formation in pancreatitis is thought to be due to acinar cell necrosis and/or ductal disruption with peripancreatic accumulations of fluid containing activated proteolytic enzymes which autodigest and weaken the arterial wall. It is commoner in male alcoholics with a history of chronic pancreatitis (80–90%), the pseudoaneurysm most often being contained within a pseudocyst. Pseudoaneurysms have also been described following pancreaticobiliary resection for neoplasia and pancreatic transplantation [6]. Rupture of a pseudoaneurysm can occur into an associated pseudocyst or through the cyst into the pancreatic duct. Other sites of bleeding include the retroperitoneum, the peritoneal cavity, direct

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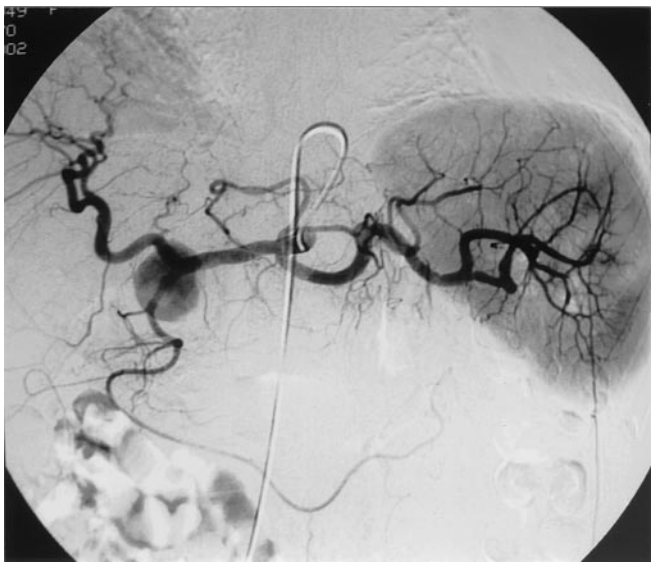

Fig. 1. Selective celiac axis catheterization (AP) demonstrating a 3.4 cm diameter pseudoaneurysm arising from the origin of the gastroduodenal artery.

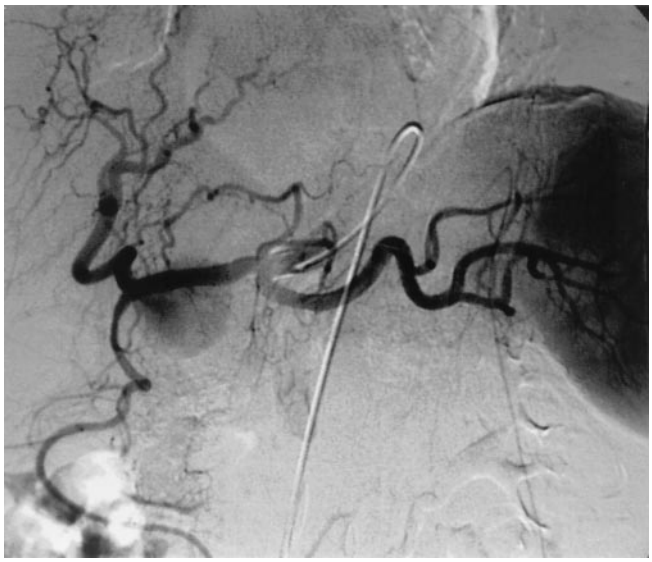

Fig. 2. LAO projection demonstrating a filling jet of contrast from the narrow-caliber neck; again note the location of the pseudoaneurysm at the origin of the gastroduodenal artery immediately below the bifurcation of the common hepatic artery.

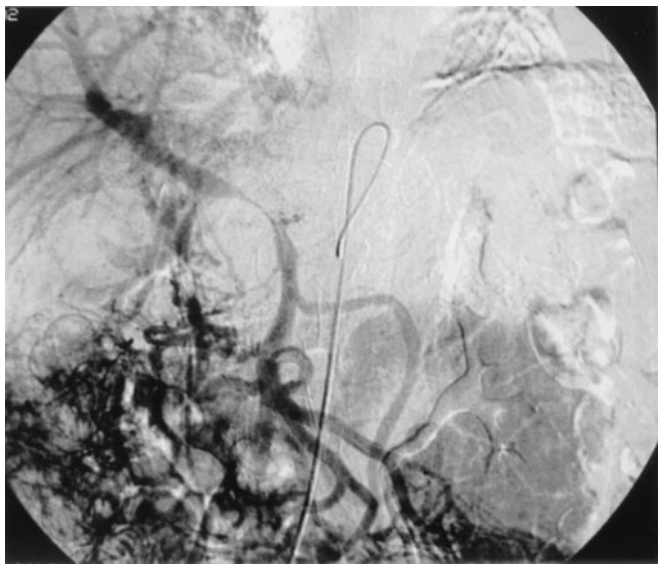

Fig. 3. Venous phase demonstrating severe compression of the portal vein by the adjacent pseudoaneurysm.

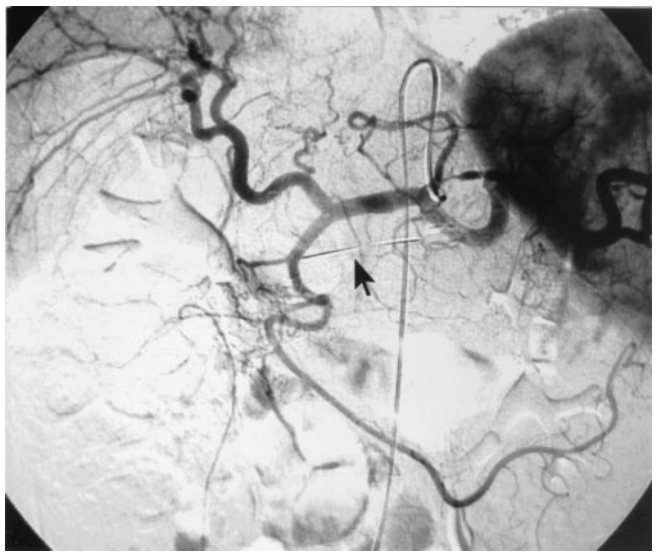

Fig. 4. Celiac axis arteriography immediately following injection with thrombin demonstrating no filling of the pseudoaneurysm sac. Note the 22 gauge spinal needle in situ (arrow).

erosion into the duodenum or other parts of the bowel. Diagnosis is usually by CT or ultrasound. Mesenteric angiography is essential for accurate localization of the vessel involved, although multislice CT and CT angiography in the future may provide adequate diagnostic information [7]. The commonest vessel affected is the splenic artery (30–50%) due to its proximity to the pancreas, followed by the gastroduodenal artery (10–15%) and the inferior and superior pancreaticoduodenal artery (10%) [8]. Important factors for successful treatment by coil occlusion are proper identification and selective catheterization of the feeding artery. Specific complications of transcatheter embolization include rupture of the pseudoaneurysm during embolisation [9, 10] and intestinal necrosis [11, 12].

Thrombin is involved in the final common pathway of the coagulation cascade; activated factor X converts prothrombin to thrombin. Thrombin then hydrolyses the peptide bonds of fibrinogen, thus allowing polymerization between fibrinogen molecules to form fibrin clot. In the presence of calcium ions, thrombin also activates factor XIII which crosslinks adjacent fibrin molecules further stabilizing the fibrin clot. Cope and Zeit [13] first described the use of thrombin for percutaneous occlusion of aneurysmal sacs in 1986. Since that time its therapeutic potential has been increasingly recognized. A recent literature review involving analysis of outcomes from multiple centers of a total of 319 patients with pseudoaneurysms in anatomically diverse locations (predominantly

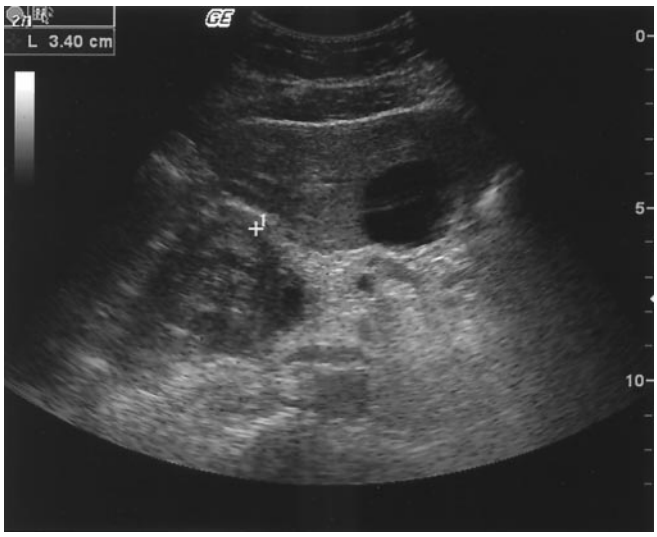

Fig. 5. Follow up two-dimensional ultrasound at 72 hr demonstrating echogenic thrombus within the pseudoaneurysm sac.

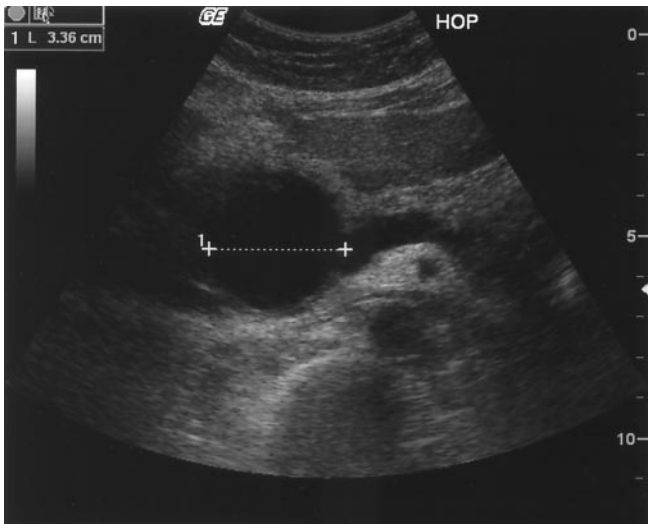

Fig. 6. Two-dimensional ultrasound at 8 weeks demonstrating persistence of a pseudocyst at the site of the previous pseudoaneurysm.

femoral) outlined a procedural success rate of 97% and complication rate of 0.95% [14]. Success was deemed to be independent of concurrent anticoagulation treatment but increased aneurysmal size did necessitate repeat injections.

Use of thrombin to treat visceral pseudoaneurysms has been rare and to our knowledge only one previous case of percutaneous treatment of a pancreatic pseudoaneurysm using thrombin exists in the literature [15–18]. Our case followed the method described by Kang et al. [19] using thrombin at a concentration of 1,000 IU/ml; however, a number of studies have demonstrated successful use of bovine thrombin in femoral pseudoaneurysms at even lower concentrations of 100 IU/ml [20, 21]. We note that despite persistence of a pseudocyst on follow-up with its associated pancreatic duct disruption and risk of leakage of proteolytic enzymes, there was no evidence of recurrence.

Potential complications of thrombin use can be broadly classified into thrombotic and immunologic. There are a number of case reports of distal thrombosis after thrombin injection but none of these resulted in serious long-term sequelae [22–25]. Once thrombin is injected, thrombosis is more or less instantaneous within the sac. If there is a small leak of material then it is felt that its physiologic action is weak and it is diluted in the fast-flowing bloodstream and inactivated by natural endothelial-derived anticoagulation factors such as anti-thrombin III. Immunologic phenomena found on repeated exposure to topical bovine thrombin include the development of antibodies (IgM and IgG) to bovine coagulation factors (in particular factor V) with a potential for cross-reactivity with human clotting factors [26]. The clinical consequences of this are quite rare but severe bleeding and coagulopathy have been reported [27]. Development of raised levels of IgE is also recognized following repeated exposure to topical thrombin [28]. One serious case of anaphylactic reaction following percutaneous treatment of a pseudoaneurysm has been documented [29]. If there is any history of repeated exposure to thrombin (e.g., chronic hemodialysis patients, previous cardiac surgery), then skin prick testing should be performed prior to injection.

A number of recent studies have demonstrated the clinical efficacy of human thrombin [30–32]. This human thrombin does not seem to incur any risk of immunologic sensitization. It is usually drawn from pooled plasma which is screened for viral hepatitis and HIV, but the theoretical risk of transfer of an as yet unknown infectious agent remains. From the evidence available human and bovine thrombin would appear to be equally efficacious, although the human form is slightly more expensive.

In conclusion, ultrasound-guided treatment of peripheral pseudoaneurysms with thrombin has been in use for a number of years. Although most of the evidence for its use is with peripheral arteries, this case further demonstrates its potential in treating visceral pseudoaneurysms, avoiding the need for more risky and costly treatment strategies.

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