

## CASE REPORTS

Rupture of True Aneurysms of the Pancreaticoduodenal Arcade:  
Treatment with Transcatheter Arterial EmbolizationM. Guijt,<sup>1</sup> O.M. van Delden,<sup>1</sup> N.A. Koedam,<sup>2</sup> E. van Keulen,<sup>2</sup> J.A. Reekers<sup>1</sup><sup>1</sup>Departments of Surgery and Radiology, Academic Medical Center, Amsterdam, The Netherlands<sup>2</sup>Departments of Surgery and Radiology, General Hospital, Hilversum, The Netherlands

## Abstract

We present 2 cases of ruptured true aneurysms of the pancreaticoduodenal arcade, underscoring the role of transcatheter arterial embolization (TAE) as the initial treatment of choice in pancreaticoduodenal arcade aneurysm. Ruptured true aneurysms of the pancreaticoduodenal artery (PDA) are uncommon and few cases have been reported, whereas false aneurysms are seen more often. The first patient we describe is a 63-year-old woman with an aneurysm of the PDA initially treated by TAE. The second case is a 67-year-old woman with an aneurysm of the inferior PDA post-operatively treated by TAE. In both patients TAE via a combined superior mesenteric artery and celiac axis approach was successful. Follow-up contrast-enhanced computed tomography showed prolonged occlusion of both aneurysms. A review of the literature concerning TAE supports our experience that TAE of ruptured aneurysms of the pancreaticoduodenal arcade, when feasible, is at least as effective as conventional surgery, but with lower morbidity and mortality. Therefore, TAE should be the initial treatment of choice in this group of patients.

**Key words:** Transcatheter arterial embolization—Retroperitoneal hemorrhage—True aneurysm—Emergency angiography

Pancreaticoduodenal artery aneurysms (PDAA) are rare [1–12]. In many cases, diagnosis of rupture is delayed because of unspecific clinical signs. They may present with abdominal pain, shock after rupture, gastrointestinal hemorrhage with hematemesis or melena, peritoneal or retroperitoneal hemorrhage, biliary colic or jaundice [1–6]. The diagnosis of acute peritoneal or retroperitoneal hemorrhage is therefore often blurred by other, more frequently occurring, differential diagnostic possibilities [7].

Visceral artery aneurysms can be divided into false and true aneurysms. False aneurysms are often seen as a complication of pancreatitis [1, 3–5]. Leakage of pancreatic enzymes damages the surrounding tissue including the gastroduodenal artery (GDA) and pancreaticoduodenal artery (PDA). Additional causes of false aneurysms include trauma, septic emboli and ruptures of the gastro-

intestinal tract [3]. True aneurysms of the GDA and PDA, on the other hand, are often associated with celiac axis stenosis [1, 5, 8]. Compensatory blood flow from the superior mesenteric artery via the pancreaticoduodenal arcade raises pressure in the GDA and PDA which leads to aneurysm formation. Traditionally PDAAAs were treated by surgery including ligation, vessel reconstruction or resection of involved organs. However, in recent years TAE has been proposed as a less invasive and equally efficacious treatment. In this paper we report two cases of ruptured true aneurysms successfully treated by TAE.

## Case Report

## Case 1

A 63-year-old woman presented to a general hospital with a 2-day history of acute upper abdominal pain radiating to the back. Aside from cholecystolithiasis her medical history was unremarkable. On arrival she was hemodynamically stable. Ultrasonography (US) of the abdomen showed a modest quantity of free intraperitoneal fluid and a hypoechoic area adjacent to the head of the pancreas. Mobile gallstones were seen in a normal gallbladder and the bile ducts were not dilated. US-guided needle aspiration of the peritoneal fluid showed blood. Contrast-enhanced computed tomography (CT) of the abdomen was subsequently performed which showed a large hematoma in the retroperitoneum adjacent to the pancreas.

Her hemoglobin dropped from 8.3 mmol/l to 6.3 mmol/l and she was transferred to our hospital for an emergency angiography. Selective angiography showed an aneurysm of the superior part of the pancreaticoduodenal artery (Fig. 1). Because there was no previous history to account for the potential development of a false aneurysm, this aneurysm was considered to be a true aneurysm. Embolization of the aneurysm was subsequently performed through a standard 5 Fr diagnostic Cobra-shaped angiography catheter (Cordis, Johnson&Johnson, Roden, The Netherlands) and a coaxial microcatheter (Renegade, Boston Scientific, Cork, Ireland). Seven microcoils (3 mm VORTX Diamond shape, Boston, Scientific, Cork, Ireland) were placed on both sides of the aneurysm by means of superselective catheterization of the celiac axis and the inferior PDA via the superior mesenteric artery (Fig. 2).

The patient remained hemodynamically stable and was discharged after 5 days. A retrospective review of the initial CT scan revealed a small contrast-filled aneurysm within the retroperitoneal hematoma. Contrast-enhanced CT after 2 months showed complete disappearance of the aneurysm.

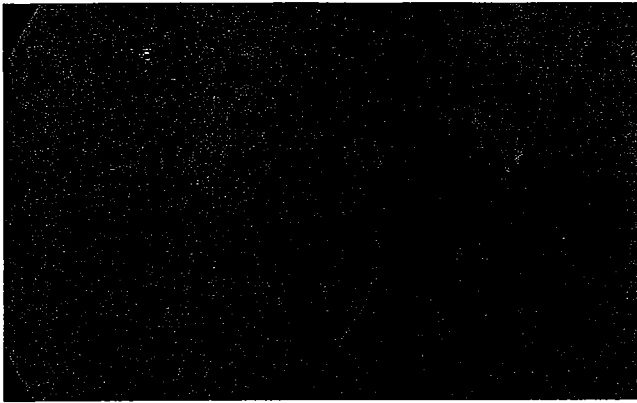


Fig. 1. Case 1. Selective angiogram of the superior mesenteric artery: An aneurysm of the pancreaticoduodenal artery (PDA) is seen with retrograde filling of the gastroduodenal artery (GDA) and celiac axis.

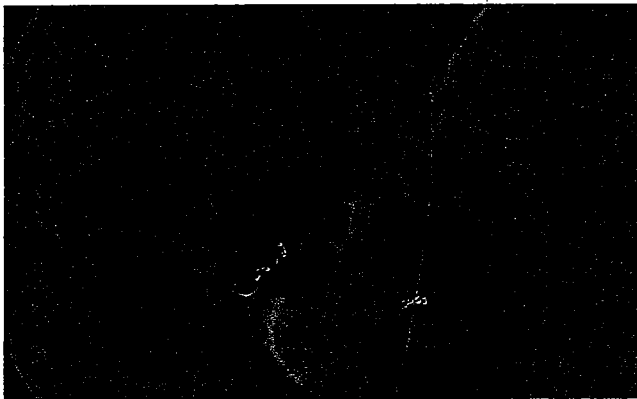


Fig. 2. Case 1. Selective angiogram of the pancreaticoduodenal arcade after proximal and distal occlusion of the aneurysm from the superior mesenteric and celiac axis.

### Case 2

The second patient was a 67-year-old woman who presented to our hospital with intense lower abdominal pain. On admission she was hemodynamically stable. Contrast-enhanced CT of the abdomen showed free intraperitoneal fluid and a large hematoma in the mesentery. Exploratory laparotomy was then performed, which confirmed the CT findings of a mesenteric hematoma and free intraperitoneal blood, but no underlying cause was found. A postoperatively performed selective visceral angiography revealed a small aneurysm of the inferior pancreaticoduodenal artery. The celiac axis showed a severe stenosis at the origin and retrograde blood flow was seen in the pancreaticoduodenal and gastroduodenal arteries via the superior mesenteric artery. Because the previous history of the patient was unremarkable and because the presence of celiac axis stenosis can potentially increase the likelihood of developing true aneurysms in the visceral circulation (see Discussion) this aneurysm was considered to be a true aneurysm. The aneurysm was subsequently embolized using a similar technique to that described in case 1. The patient remained hemodynamically stable, but recovery was complicated by transient paralytic ileus. She was discharged 30 days after admission and a follow-up contrast-enhanced CT scan 1 month later confirmed disappearance of the aneurysm.

### Discussion

Although false and true aneurysms of the GDA and PDA represent only 2–3% of all visceral artery aneurysms, they have the highest

lethal potential [4]. Rupture rates ranging from 50% to 90% have been reported compared with a rupture rate of only 3–9% for splenic artery aneurysms, which are the most common visceral artery aneurysms. Between 50% and 75% of patients die following rupture. Because of this high mortality rate, PDAAs require prompt treatment [9]. Before the 1980s all visceral aneurysms were treated by emergency surgery. Since then, several studies have described embolization of visceral artery aneurysms and more recently transcatheter arterial embolization (TAE) has become the treatment of choice in many centers.

Rasuli and Desmarais [10] report one of the earlier cases (1983) of successful TAE of an aneurysm of the GDA in a 47-year-old man. They recommend TAE as optional treatment to traditional surgery in GDAA. This suggestion is supported by Yoneyama et al. [1], who report a case of a ruptured PDAA treated by TAE using a microcatheter and coils. The authors propose TAE as a safer and more effective way of treating PDAA. They emphasize the high mortality risk associated with surgery in the area of the PDA, which is difficult to access. Furthermore they report that TAE can be performed directly after diagnostic angiography, which avoids the patient having to undergo several invasive procedures at different times. Coll et al. [6] share the assumption that TAE is at least, if not more, as effective as surgery. This conclusion is based on a review of the English literature from 1966 to 1995, which reports 83 cases of aneurysms of the PDA (40 before and 42 after 1980). No patients were reported before 1980 as having undergone embolization, 27 had undergone surgery and 10 received no treatment. Of the 27 patients treated by surgery, 7 patients died yielding a mortality rate of 26%. The second group of patients—those treated after 1980—showed an overall mortality rate of 17%. Thirteen patients underwent TAE, 25 patients were treated by surgery and the remaining 4 patients received no treatment. The mortality rate for surgery was 20% (5/25) compared with 0 for the TAE group (0/13). These figures suggest that TAE should be the initial treatment for the majority of aneurysms of the PDA. However, considering the small number of cases reported in the second group (13 TAE vs 25 surgery) and the fact that 2 patients had to be operated on because of persistent bleeding, the difference in mortality rate becomes somewhat less significant but remains important. Morita et al. [11] report a mortality rate of 12.9% for those initially treated by surgery and a mortality rate of 2.1% for those initially treated by embolization. They also compared the results of surgery with those of embolization with respect to aneurysm disappearance (87.2% vs 97.5%, respectively), hemostasis rate (78.2% vs 97.8%) and incidence of complications (10.5% vs 5.9%). These data strongly suggest that TAE is a treatment modality superior to traditional surgery.

On the other hand, de Perrot et al. [12] state that embolization is not always the preferred treatment. In some patients, they note, it can be extremely difficult to selectively cannulate the feeding vessels. Furthermore, TAE may be associated with rupture of the aneurysm or ischemic injury resulting from reduced blood flow according to the authors [12]. Finally, Rokke et al. [3] identify several additional problems that can occur during embolization such as difficult access, unintentional occlusion of a vessel, dislodgment of the occluding device, formation of a pseudoaneurysm at the site of entry and recanalization [3].

In our opinion, most of these listed problems are of technical nature and are related to the experience of the interventional radiologist rather than to the method itself. In addition, we think that knowledge of the patency and collateral flow of visceral arteries is

mandatory in treating aneurysms of the PDA and GDA. In many of the cases reported in the literature in which TAE was not successful, the collateral flow to the aneurysm was ignored, leading to persistence of the aneurysm. Yonema et al. and de Perrot et al. share this assumption and emphasize that aneurysms should always be approached from two sides for preserved hemostasis and to avoid retrograde flow. In a recent case report Ogino et al. [13] confirm this need for a two-sided approach to the parent artery. They also emphasize that management of a possible celiac axis stenosis is necessary to prevent recurrence of aneurysm formation. In conclusion, transcatheter embolization of aneurysms of the pancreaticoduodenal arcade appears to be more effective than conventional surgery with less mortality and morbidity. TAE of PDAA's should be the initial treatment in both hemodynamically stable and unstable patients. Only when embolization fails or appears insufficient should surgery be undertaken.

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