Management of pancreaticoduodenal artery aneurysm associated with coeliac artery stenosis

SK Kamarajah¹, S Kharkhanis², M Duddy², J Isaac¹, RP Sutcliffe¹, H Mehrzad², BVM Dasari¹

¹ Department of Hepatobiliary and Pancreatic Surgery, Queen Elizabeth Hospital, Birmingham, UK

² Department of Interventional Radiology, Queen Elizabeth Hospital, Birmingham, UK

ABSTRACT

Pancreaticoduodenal and gastroduodenal artery aneurysms are rare but require early radiological or surgical intervention due to a high risk (61%) of rupture. A 71-year-old woman presented with an incidental 30-mm aneurysm arising from the inferior pancreaticoduodenal artery associated with coeliac axis stenosis. She underwent embolisation of the pancreaticoduodenal aneurysm, but the coeliac axis stenosis was not amenable to radiological intervention. She remained well at six months of follow-up and a repeat computed tomography angiogram six months later reported stable appearances. The management of pancreaticoduodenal aneurysms is discussed.

KEYWORDS

Visceral aneurysm – Endovascular – Outcome

Accepted 14 January 2019

CORRESPONDENCE TO

Bobby Dasari, E: bobby.dasari@yahoo.com

Introduction

Aneurysms of the pancreaticoduodenal and gastroduodenal arteries account for 2% of all visceral aneurysms but have a risk for rupture regardless of size, requiring early intervention.¹ Although some aneurysms are congenital or post-inflammatory, there is a well-documented association with coeliac artery stenosis or occlusion.² Typically, the latter are encountered in an older patient cohort with hyperdynamic flow in the superior mesenteric artery–gastroduodenal–hepatic artery axis to compensate for decreased flow through the coeliac stenosis.

Optimal management of these lesions is challenging, as the distal flow to end organs is at risk should there be a rupture of the aneurysm or a disruption of the collateral flow with endovascular or surgical treatment options. Since coil embolisation can interrupt major collateral flow between the superior mesenteric artery and the coeliac axis, some have suggested coeliac artery revascularisation to prevent hepatic, splenic or upper gastrointestinal ischaemia.^{3–5} Coeliac artery revascularisation should also help to prevent recurrence of aneurysms in the pancreaticoduodenal arcade.⁶ However, coeliac axis stenosis is not always suitable for endovascular management because of the technical difficulty of cannulating the coeliac or extensive calcification of the coeliac origin. We discuss the management of aneurysm of the branch of pancreaticoduodenal artery associated with coeliac artery stenosis.

Case history

A 71-year-old woman was incidentally diagnosed to have a 32-mm aneurysm off the inferior pancreaticoduodenal artery. She was also noted to have an adjacent smaller 15-mm aneurysm (Fig 1) and coeliac artery stenosis. Considering the patient's good overall health and performance status, it was decided at both hepatobiliary and vascular multidisciplinary meetings that endovascular intervention should be recommended. The patient had declined invasive surgery. A detailed plan of the complex vascular anatomy was made to ascertain the optimal endovascular approach (Fig 2).

Following departmental protocol, the patient was seen in our interventional radiology clinic and the risks and benefits of the procedure were explained, following which informed consent was obtained.

The procedure was carried out under general anaesthesia, to allow for a possible lengthy procedure. Vascular access was obtained in both common femoral arteries with 5-French sheaths. Initial aortogram demonstrated complete occlusion of the previous coeliac axis stenosis. Multiple attempts to recanalise the coeliac axis were unsuccessful. Hence, the preferred plan to revascularise the coeliac axis, embolise both aneurysms and stent-graft the superior mesenteric artery could not be carried out. We therefore proceeded to the secondary option to embolise only the larger pancreaticoduodenal artery, so as to maintain hepatic

Figure 1 Computed tomography scan demonstrating 13-mm aneurysm and coeliac artery stenosis.

circulation via the superior mesenteric artery. Following cannulation of the superior mesenteric artery, a Progreat® microcatheter (Terumo) was used to obtain access into the larger aneurysm cavity. We proceeded to embolise the aneurysm with multiple detachable Ruby® microcoils (Penumbra) and achieved a packing density of 22.6% until no further contrast opacification of aneurysm cavity was evident. The smaller PDA aneurysm could not be treated as per our preprocedure plan and was left alone. Vascular access haemostasis was achieved with bilateral 6-French Angioseal® (Terumo). The patient was observed as an inpatient overnight and discharged the next day with no immediate complications.

Follow-up computed tomography performed six months later, which demonstrated that the appearance of the embolised larger aneurysm was satisfactory and the untreated smaller aneurysm appeared to be stable.

Discussion

GDA and pancreaticoduodenal artery aneurysms are reported to account for 1% and 2% of all visceral artery aneurysms, respectively. The pathophysiology has been related to increased collateral flow due to coeliac artery compromise resulting in enlargement and weakening of the media of the pancreaticoduodenal arcade arteries. The incidence of peripancreatic artery aneurysms associated with coeliac artery occlusive disease may be under appreciated and underreported, ranging between 31% and 97%.^{1,7} The majority of patients present with abdominal pain, although 25% remain asymptomatic. When symptoms occur, they often present with serious illnesses, including obstructive jaundice (1%) and abdominal pain (54%) due to rupture.^{1,8} The overall reported rupture rate was 61%.⁹ Previous reports have demonstrated that size does not correlate to risk of rupture, given the many reports of rupture

Ao, aorta
AIPDa, anterior inferior pancreaticoduodenal artery
ASPDa, anterior superior pancreaticoduodenal artery
CA, coeliac artery
CHA, common hepatic artery
GDA, gastroduodenal artery
HA, hepatic artery
IPDa, inferior pancreaticoduodenal artery
PIPDa, posterior inferior pancreaticoduodenal artery
PSPDa, posterior superior pancreaticoduodenal artery
SMA, superior mesenteric artery

Figure 2 A detailed plan of the complex vascular anatomy.

in aneurysms less than 10 mm.^{1,7,8,10} The majority of ruptured aneurysms were likely contained in the retroperitoneum and early interventions coupled with advances in preoperative resuscitation and postoperative care allow effective treatment. However, it needs meticulous surgical planning and a back-up option to restore the blood flow to hepatic arteries using an aortic conduit.

Endovascular therapy is a favoured option in most patients with coeliac artery occlusive disease with asymptomatic pancreaticoduodenal artery or gastroduodenal artery aneurysms. Endovascular thrombosis is undertaken in well-selected patients, with a lateral sac, using a variety of agents to occlude these aneurysms and their feeding vessels.^{1,11,12} Stent-graft placement may be suitable to exclude the aneurysmal sac but may prove difficult in treating aneurysms of the smaller branches of the

gastrooduodenal artery such as the pancreaticoduodenal artery, owing to the tortuosity and the narrow calibre of the vessels that are potential landing zones of the stent. Endovascular embolisation of gastrooduodenal artery or pancreaticoduodenal artery aneurysm does not jeopardise blood flow to the foregut because of propagation of the thrombus but could result in occluding the collateral flow completely that could potentially contribute to ischemia of the foregut. To avoid this, revascularisation of the coeliac artery before or shortly after treating the pancreaticoduodenal artery aneurysm is an option.^{7,15} Late complications, including aneurysmal rupture, may occur from endovascular therapies, so long-term follow-up of patients is recommended.¹⁴

Open surgical treatment of gastrooduodenal and pancreaticoduodenal artery aneurysms is performed when endovascular therapy fails, is technically inappropriate or in haemodynamically unstable patients. During an open procedure, foregut ischaemia during temporary occlusion of the affected artery requires an expeditious arterial reconstruction to restore more normal coeliac artery flow.^{15,16} Such revascularisation entails reanastomosis of the affected arteries, release of median arcuate ligament entrapment of the coeliac artery, aortocoeliac or aortohepatic artery bypass.^{11,15} If no foregut ischemia is present, simple ligation of the aneurysm's entering and exiting arteries can be done while preserving the collateral vessels. Open surgical treatment of gastrooduodenal artery aneurysms is technically less challenging than pancreaticoduodenal artery aneurysms, since the former are usually more anterior to the pancreas and distant from the superior mesenteric artery. Although elective treatment of these aneurysms by experienced physicians has been accomplished without significant mortality, open operations carry a greater reported risk of procedure-related morbidity and mortality than do endovascular interventions.^{8,17}

Conclusion

The patient discussed here is an elderly patient with comorbidities and would have been a high-risk candidate for surgical intervention. She was initially considered for conservative management but with careful evaluation of the reconstructed arterial anatomy, she was counselled and consented for endovascular therapy. The relative rarity of true peripancreatic artery aneurysms associated with

coeliac artery narrowing makes it difficult to define their exact natural history. Careful decision making with patients and multidisciplinary discussion are required on a case-by-case basis for optimal management of these aneurysms.

References

1. Corey MR, Ergul EA, Cambria RP et al. The natural history of splanchnic artery aneurysms and outcomes after operative intervention. *J Vasc Surg* 2016; **63**: 949–957.
2. Kalva SP, Athanasoulis CA, Greenfield AJ et al. Inferior pancreaticoduodenal artery aneurysms in association with celiac axis stenosis or occlusion. *Eur J Vasc Endovasc Surg* 2007; **33**: 670–675.
3. Reilly LM, Ammar AD, Stoney RJ, Ehrenfeld WK. Late results following operative repair for celiac artery compression syndrome. *J Vasc Surg* 1985; **2**: 79–91.
4. Mora JD. Coeliac-axis artery stenosis with aneurysmal calcification of the collateral supply. *Australas Radiol* 1976; **20**: 252–254.
5. Proud G, Chamberlain J. Aneurysm formation on the small pancreatic arteries in association with coeliac axis compression. *Ann R Coll Surg Engl* 1978; **60**: 294–297.
6. Tien YW, Kao HL, Wang HP. Celiac artery stenting: a new strategy for patients with pancreaticoduodenal artery aneurysm associated with stenosis of the coeliac artery. *J Gastroenterol* 2004; **39**: 81–85.
7. Bageacu S, Cuilleron M, Kaczmarek D, Porcheron J. True aneurysms of the pancreaticoduodenal artery: successful non-operative management. *Surgery* 2006; **139**: 608–616.
8. Vandy FC, Sell KA, Eliason JL et al. Pancreaticoduodenal and Gastrooduodenal Artery Aneurysms Associated with Celiac Artery Occlusive Disease. *Ann Vasc Surg* 2017; **41**: 32–40.
9. Brocker JA, Maher JL, Smith RW. True pancreaticoduodenal aneurysms with celiac stenosis or occlusion. *Am J Surg* 2012; **204**: 762–768.
10. Takao H, Doi I, Watanabe T et al. Natural history of true pancreaticoduodenal artery aneurysms. *Br J Radiol* 2010; **83**: 744–746.
11. Flood K, Nicholson AA. Inferior pancreaticoduodenal artery aneurysms associated with occlusive lesions of the coeliac axis: diagnosis, treatment options, outcomes, and review of the literature. *Cardiovasc Intervent Radiol* 2013; **36**: 578–587.
12. Dave B, Sharma A, Kwolek C et al. Percutaneous transcatheter arterial embolization of inferior pancreaticoduodenal artery aneurysms associated with celiac artery stenosis or occlusion. *Catheter Cardiovasc Interv* 2010; **75**: 663–672.
13. Bowens NM, Woo EY, Fairman RM. Reno-hepatic artery bypass for an inferior pancreaticoduodenal artery aneurysm with associated celiac occlusion. *J Vasc Surg* 2011; **53**: 1,696–1,698.
14. de Perrot M, Berney T, Deleaval J et al. Management of true aneurysms of the pancreaticoduodenal arteries. *Ann Surg* 1999; **229**: 416–420.
15. Bellosta R, Luzzani L, Carugati C et al. Pancreaticoduodenal artery aneurysms associated with coeliac axis occlusion. *Ann Vasc Surg* 2005; **19**: 534–539.
16. Quandalle P, Chambon JP, Marache P et al. Pancreaticoduodenal artery aneurysms associated with coeliac axis stenosis: report of two cases and review of the literature. *Ann Vasc Surg* 1990; **4**: 540–545.
17. Coll DP, Ierardi R, Kerstein MD et al. Aneurysms of the pancreaticoduodenal arteries: a change in management. *Ann Vasc Surg* 1998; **12**: 286–291.