Natural history of true pancreaticoduodenal artery aneurysms

^{1,2}H TAKAO, MD, ¹I DOI, MD, ¹T WATANABE, MD, ²N YOSHIOKA, MD, DMSc and ²K OHTOMO, MD, DMSc

¹Department of Radiology, Showa General Hospital, 2-450 Tenjincho, Kodaira, Tokyo, Japan, and ²Department of Radiology, Graduate School of Medicine, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, Japan

ABSTRACT. Advances in non-invasive diagnostic techniques, such as CT and ultrasonography, have improved our ability to detect unruptured pancreaticoduodenal artery aneurysms. No definitive study evaluating the natural history of these lesions or their preferred method of treatment has been published. In this report, we describe five patients with eight unruptured true pancreaticoduodenal artery aneurysms followed without treatment. Of these patients, four had coeliac axis stenosis ($n=1$) or occlusion ($n=3$) and one had occlusion of the superior mesenteric artery. The mean diameter of the aneurysms was 12.0 mm (range 7–17 mm). The mean duration of follow-up was 29.4 months (range 6–57 months). There was no aneurysm rupture during a total of 147 patient-months (243 aneurysm-months) of follow-up. Of the eight aneurysms, three increased in size over the follow-up period. We conclude that the risk of rupture of true pancreaticoduodenal artery aneurysms might be lower than expected from the data on ruptured aneurysms; however, careful follow-up of untreated aneurysms is necessary.

Received 4 May 2009
Revised 15 July 2009
Accepted 3 August 2009

DOI: 10.1259/bjr/17700576

© 2010 The British Institute of
Radiology

True pancreaticoduodenal artery aneurysms are rare, accounting for 2% of all visceral aneurysms. More than half of true pancreaticoduodenal artery aneurysms are associated with coeliac axis stenosis or occlusion [1]. The development of pancreaticoduodenal artery aneurysms might be related to increased retrograde blood flow through the pancreaticoduodenal arcades when there is stenosis or occlusion in the coeliac axis [2]. Aneurysm formation is generally preceded by enlargement of the arcades to accommodate the increased blood flow.

Although 60% of reported cases of true pancreaticoduodenal artery aneurysms presented with rupture [1], advances in non-invasive diagnostic techniques, such as CT and ultrasonography, have improved our ability to detect unruptured pancreaticoduodenal artery aneurysms. These are now found as incidental findings, usually by CT or ultrasonography. No definitive study evaluating the natural history of these lesions or their preferred method of treatment has been published. In this report, we retrospectively reviewed unruptured true pancreaticoduodenal artery aneurysms followed without treatment to assess the natural history of these lesions.

Methods and materials

A retrospective review was performed of patients with unruptured pancreaticoduodenal artery aneurysms who were followed without treatment at our institutions. False aneurysms were excluded. Eight aneurysms in five patients were identified: two patients had single unruptured pancreaticoduodenal artery aneurysms and three had two unruptured pancreaticoduodenal artery

aneurysms. The mean patient age was 67.8 years (range 48–82 years). Three patients were male and two female. Of the five patients included in the study, four had coeliac axis stenosis ($n=1$) or occlusion ($n=3$) and one had occlusion of the superior mesenteric artery. The mean diameter of the aneurysms was 12.0 mm (range 7–17 mm). All the aneurysms were incidentally discovered. The diagnosis was established by contrast-enhanced CT ($n=5$) and/or digital subtraction angiography ($n=2$). Imaging follow-up was performed with contrast-enhanced CT ($n=4$) or ultrasonography ($n=1$). Follow-up information was obtained by means of a review of medical records. Institutional review board approval was not necessary for retrospective case reports.

Results

The mean duration of follow-up was 29.4 months (range 6–57 months) with a total of 147 patient-months of follow-up. Of the five patients, no patient had an aneurysm rupture during follow-up. There was no aneurysmal rupture during a total of 243 aneurysm-months of follow-up. Of the eight aneurysms, five remained stable in size and three increased in size. Details of each patient are given in Table 1.

Discussion

The management of patients with unruptured pancreaticoduodenal artery aneurysms depends on the natural history of these lesions and on morbidity and mortality rates associated with their repair. Several authors have recommended definitive treatment of all true pancreaticoduodenal artery aneurysms, based on the fact that 60% of reported aneurysms were ruptured and because there was no difference in size between

Address correspondence to: Hidemasa Takao, Department of Radiology, Graduate School of Medicine, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8655, Japan. E-mail: takaoh-tyk@umin.ac.jp

Table 1. Characteristics of patients with unruptured true pancreaticoduodenal artery aneurysms followed without treatment

Patient	Age (years)	Sex	Coeliac axis stenosis or occlusion	Aneurysm		Rupture	Follow-up	
				Location	Size (mm)		Duration (months)	Size (mm)
1	80	Male	— ^a	IPDA	11	—	22	12
				PPDA	10			11
2	48	Female	+	IPDA	17	—	6	17
3	54	Male	+	APDA	11	—	45	18
4	75	Male	+	IPDA	16	—	57	16
				PPDA	7			7
5	82	Female	+	APDA	15	—	17	15
				APDA	9			9

^aThere was occlusion of the superior mesenteric artery. APDA, anterior pancreaticoduodenal artery; IPDA, inferior pancreaticoduodenal artery; PPDA, posterior pancreaticoduodenal artery.

ruptured and unruptured aneurysms [3, 4]. However, the natural history of unruptured aneurysms can not be extrapolated from patients with ruptured aneurysms. Most unruptured intracranial aneurysms that are less than 10 mm in diameter do not rupture, whereas the mean diameter of aneurysms in patients who present with subarachnoid haemorrhage is less than 10 mm [5]. In a large prospective study evaluating the natural history of unruptured intracranial aneurysms, the annual rupture rates for anterior circulation aneurysms were 0 (aneurysms <7 mm), 0.5% (7–12 mm), 3.1% (13–24 mm) and 9.7% (≥ 25 mm) [5–7]. No definitive study evaluating the natural history of unruptured pancreaticoduodenal artery aneurysms has been published. In our patients, there was no aneurysm rupture during a total of 147 patient-months (243 aneurysm-months) of follow-up. Of the eight aneurysms, however, three increased in size over the follow-up period. The risk of rupture of true pancreaticoduodenal artery aneurysms could be lower than expected from the data on ruptured aneurysms.

The risk of complications from preventive treatment of unruptured pancreaticoduodenal artery aneurysms is unclear. In pancreaticoduodenal artery aneurysms associated with coeliac axis stenosis or occlusion, embolisation carries a potential risk of ischaemic injury resulting from the absence of major collateral vessels. Bageacu et al [4] reported nine cases of true pancreaticoduodenal artery aneurysms treated by coil embolisation: seven patients had ruptured aneurysms and two had unruptured aneurysms. coeliac axis stenosis or occlusion was identified in three patients. One patient with an unruptured aneurysm died from meningitis a few weeks after embolisation. Suzuki et al [8] reported seven cases of ruptured pancreaticoduodenal artery aneurysms associated with coeliac axis stenosis that were treated with transcatheter arterial embolisation. There were no complications associated with embolisation. Sugiyama et al [9] reported five cases of splanchnic artery aneurysms associated with coeliac artery stenosis, owing to compression by the median arcuate ligament. Three patients had ruptured aneurysms that were treated by coil embolisation. There were no reports of complications associated with embolisation.

Pancreaticoduodenal artery aneurysm rupture is most commonly retroperitoneal. A review of reported cases showed that ruptured pancreaticoduodenal artery aneurysms had a mortality rate of 21% [1]. A recent decision analysis has demonstrated that the effectiveness

of preventive treatment of unruptured pancreaticoduodenal artery aneurysms depends on the aneurysm rupture rate, mortality rate of preventive treatment and patient age [10]. Enlarging aneurysms can be considered unstable and probably have a higher risk of rupture than stable aneurysms [11]. Pancreaticoduodenal artery aneurysms associated with coeliac axis (or superior mesenteric artery) stenosis or occlusion have a higher risk of complications from treatment. It is important to balance the risk of aneurysm rupture against the risk of complications from preventive treatment. For those with untreated unruptured intracranial aneurysms, it is recommended that aneurysms are monitored annually for 2 to 3 years and then every 2 to 5 years thereafter if the aneurysms are clinically and radiographically stable [12]. Similar follow-up should be considered for those with untreated pancreaticoduodenal artery aneurysms.

There are several limitations to our data. Firstly, this was a retrospective review and had limitations owing to the retrospective nature of the data collection. Secondly, the number of patients was small; however, true pancreaticoduodenal artery aneurysms are rare. This is the largest series of unruptured pancreaticoduodenal artery aneurysms followed without treatment. Finally, in our patients, imaging follow-up was performed with contrast-enhanced CT or ultrasonography. It is possible, therefore, that subtle changes in aneurysm size were unreliable.

In summary, we describe five cases with eight unruptured true pancreaticoduodenal artery aneurysms followed without treatment. There was no aneurysm rupture during a total of 147 patient-months (243 aneurysm-months) of follow-up. Of the eight aneurysms, however, three increased in size over the follow-up period. The risk of rupture of true pancreaticoduodenal artery aneurysms might be lower than expected from the data on ruptured aneurysms; however, careful follow-up of untreated aneurysms is necessary.

References

- Moore E, Matthews MR, Minion DJ, Quick R, Schwarcz TH, Loh FK, et al. Surgical management of peripancreatic arterial aneurysms. *J Vasc Surg* 2004;40:247–53.
- Kalva SP, Athanasoulis CA, Greenfield AJ, Fan CM, Curvelo M, Waltman AC, et al. Inferior pancreaticoduodenal artery aneurysms in association with coeliac axis stenosis or occlusion. *Eur J Vasc Endovasc Surg* 2007;33:670–5.

3. de Perrot M, Berney T, Deleaval J, Bühler L, Mentha G, Morel P. Management of true aneurysms of the pancreaticoduodenal arteries. *Ann Surg* 1999;229:416–20.
4. Bageacu S, Cuilleron M, Kaczmarek D, Porcheron J. True aneurysms of the pancreaticoduodenal artery: successful non-operative management. *Surgery* 2006;139:608–16.
5. Wiebers DO, Whisnant JP, Huston J 3rd, Meissner I, Brown RD Jr, Piepgras DG, et al. Unruptured intracranial aneurysms: natural history, clinical outcome, and risks of surgical and endovascular treatment. *Lancet* 2003;362:103–10.
6. Takao H, Nojo T. Treatment of unruptured intracranial aneurysms: decision and cost-effectiveness analysis. *Radiology* 2007;244:755–66.
7. Takao H, Nojo T, Ohtomo K. Cost-effectiveness of treatment of unruptured intracranial aneurysms in patients with a history of subarachnoid hemorrhage. *Acad Radiol* 2008;15:1126–32.
8. Suzuki K, Tachi Y, Ito S, Maruyama K, Mori Y, Komada T, et al. Endovascular management of ruptured pancreaticoduodenal artery aneurysms associated with coeliac axis stenosis. *Cardiovasc Intervent Radiol* 2008;31:1082–7.
9. Sugiyama K, Takehara Y. Analysis of five cases of splanchnic artery aneurysm associated with coeliac artery stenosis due to compression by the median arcuate ligament. *Clin Radiol* 2007;62:688–93.
10. Takao H, Nojo T, Ohtomo K. True pancreaticoduodenal artery aneurysms: a decision analysis. *Eur J Radiol* 2010;75:110–13.
11. Juvela S, Poussa K, Porras M. Factors affecting formation and growth of intracranial aneurysms: a long-term follow-up study. *Stroke* 2001;32:485–91.
12. Wiebers DO, Piepgras DG, Meyer FB, Kallmes DF, Meissner I, Atkinson JL, et al. Pathogenesis, natural history, and treatment of unruptured intracranial aneurysms. *Mayo Clin Proc* 2004;79:1572–83.