

Endovascular management in abdominal visceral arterial aneurysms: A pictorial essay

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Abstract

Visceral artery aneurysms (VAAs) include aneurysms of the splanchnic circulation and those of the renal artery. Their diagnosis is clinically important because of the associated high mortality and potential complications. Splenic, superior mesenteric, gastroduodenal, hepatic and renal arteries are some of the common arteries affected by VAAs. Though surgical resection and anastomosis still remains the treatment of choice in some of the cases, especially cases involving the proximal arteries, increasingly endovascular treatment is being used for more distal vessels. We present a pictorial review of various intra-abdominal VAAs and their endovascular management.

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Key words: Visceral arterial aneurysm; Pseudoaneu-

rism; Endovascular management; Coil embolization; Imaging

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INTRODUCTION

The entity of visceral artery aneurysms (VAAs) includes aneurysms of the splanchnic circulation and those of the renal artery. Aneurysms of the splanchnic circulation include aneurysms of the celiac trunk, superior mesenteric artery (SMA), inferior mesenteric artery or their branches. Though rare, their diagnosis remains clinically important because of the high mortality and potential complications associated with them^[1,2].

Splenic artery aneurysms (SAAs) are the most common, comprising more than half the VAAs, followed in frequency by aneurysms of the hepatic artery (20%), SMA (5%), celiac trunk (4%) and other branches of the celiac and SMA^[2]. The inferior mesenteric artery is a rare site for VAAs. Renal artery aneurysms are relatively common but have a natural history which is distinct from that of splanchnic artery aneurysms.

True aneurysms have all the layers of the arterial wall intact, whereas a pseudoaneurysm is defined as a pulsating, encapsulated hematoma communicating with the lumen of the ruptured vessel. Most true VAAs are degenerative. Atherosclerosis, vasculitis, and fibromuscular dysplasia are other causes of true VAAs. Pseudoaneurysms may occur

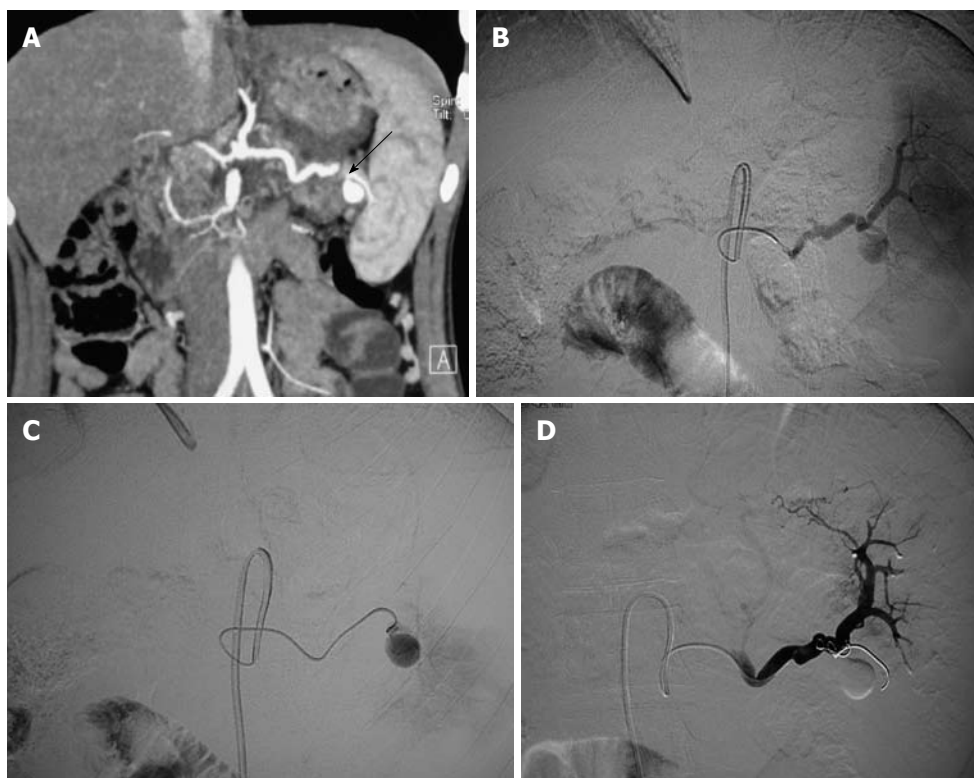


Figure 1 Splenic artery aneurysm in a 21-year-old asymptomatic female. A: Coronal maximum intensity projection image of computed tomography angiogram reveals a pseudoaneurysm from the distal splenic artery at the hilum with a narrow neck (arrow); B, C: Digital subtraction angiography images reveal the pseudoaneurysm; D: After selective catheterization, the aneurysm was treated by coiling which resulted in complete occlusion in the aneurysm sac; visualized in the post-procedure image.

secondary to iatrogenic or non-iatrogenic trauma, tumors, infection (mycotic) and rarely in the setting of atherosclerotic ulcer or primary or secondary vasculitis.

Management can be surgical or endovascular. In general, endovascular repair is preferred for most VAAs. General indications for treatment of VAAs include: a size greater than twice the caliber of the artery; rapidly increasing size; symptomatic aneurysms; aneurysms in women of child-bearing age group due to a high risk of rupture; and mycotic aneurysms.

Metallic coils can be used alone or along with Gelfoam. Gelfoam (pledget or slurry form) can be used as a temporary embolizing agent, whereas coils act as permanent agents. Coils should be used in the appropriate size because use of small size of coil may lead to distal embolization and inadequate occlusion, whereas larger size of coil prevents the coil from achieving its shape.

Cyanoacrylate glue is another, less commonly, used embolizing material in VAAs. Use of glue needs special precautions, which take the form of using non-ionic solutions such as lipiodol for mixing and dextrose for catheter flushing.

SAA

SAA (Figure 1) account for 60% of all VAAs. Multiparous females are most commonly affected. Etiology is multifactorial but the most common underlying pathoge-

netic mechanism is the degeneration of the elastic fibres of the media as a result of exposure to estrogen^[3]. The most common site is the middle or distal segment of the splenic artery at the point of branching. SAAs are usually small (< 2 cm), and saccular. They are incidentally diagnosed on imaging, carry up to 10% risk of rupture, and should be considered in the differential diagnosis of acute abdominal pain with shock. Multiple aneurysms and aneurysms from the anomalous origin of the splenic artery from the SMA have been reported.

Endovascular treatment using coil embolization is preferred for distal aneurysms, whereas stent grafts are suitable for the proximal location^[4].

HEPATIC ARTERY ANEURYSM

Hepatic artery aneurysms (HAAs) are more common in men. Around half of the HAAs are iatrogenic, associated with interventional biliary procedures, with the rest being related to trauma (Figures 2 and 3), infection, vasculitis and atherosclerosis^[3]. Most are asymptomatic, with symptomatic HAAs causing acute epigastric pain, jaundice and hemobilia. The risk of rupture is 20%-40%. The majority of HAAs are solitary, saccular and extrahepatic.

An aneurysm distal to the origin of the gastroduodenal artery (GDAs) should be treated with excision and reconstruction; whereas a lesion proximal to this point can be treated by embolization, because the hepatic perfusion is

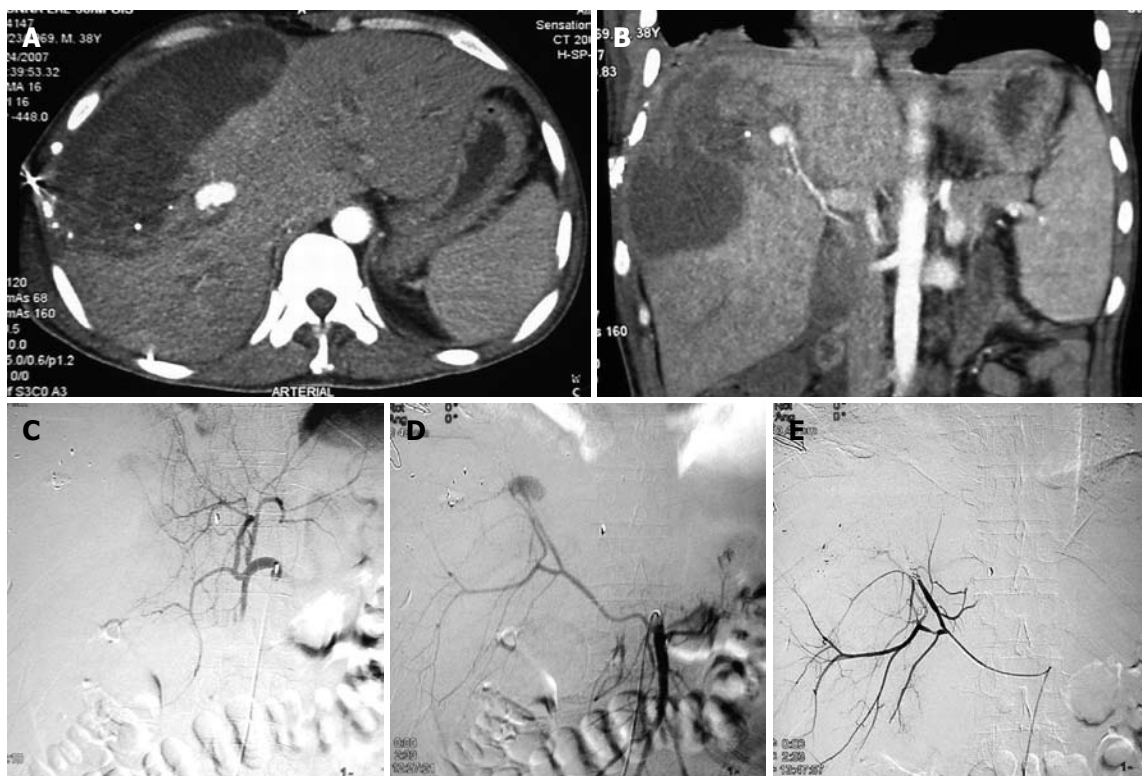


Figure 2 Traumatic pseudoaneurysm of a replaced right hepatic artery. A 38-year-old male presented with hypotension and falling hematocrit after a road traffic accident. A, B: Axial contrast-enhanced computed tomography of the abdomen (A) and coronal MIP image (B) revealed a large pseudoaneurysm (arrows) in the right lobe of the liver and a large hematoma in the liver parenchyma extending to the subcapsular location; C: DSA image after selective catheterization of the celiac trunk failed to reveal any aneurysm; D: Selective superior mesenteric artery (SMA) catheterization revealed a replaced right hepatic artery arising from the SMA and a pseudoaneurysm arising from it; E: Treated with coil embolization.



Figure 3 Traumatic right hepatic artery aneurysm. A 45-year-old male presented 2 mo after a road traffic accident with melena. A: Abdominal non-contrast computerized tomography revealed a hyperdense hematoma in the gall bladder lumen; B, C: Abdominal contrast-enhanced computed tomography axial (B) and coronal reformatted images (C) revealed a large pseudoaneurysm of the right hepatic artery (arrows); D: Selective catheter angiogram of the hepatic artery revealed the large pseudoaneurysm; E: Successful treatment by coil embolization (e).



Figure 4 Coil embolization in an superior mesenteric artery aneurysm in a patient with chronic calcific pancreatitis. A, B: Axial contrast-enhanced computed tomography of the abdomen revealed dilated main pancreatic duct and coarse calcification in the head of the pancreas, a large partially thrombosed pseudoaneurysm was apparent as a contrast filled globular structure in the head; C, D: Selective abdominal angiography of the superior mesenteric artery revealed the jet of injected contrast into the pseudoaneurysm cavity (D); E, F: Coil embolization was performed to occlude the neck (E) which resulted in complete occlusion and non-filling of the aneurysm (F).



Figure 5 Endovascular management of a gastroduodenal artery aneurysm secondary to chronic calcific pancreatitis. A, B: Axial image (A) and coronal reformatted image (B) of a computed tomography angiogram reveal features of acute on chronic calcific pancreatitis and a small saccular pseudoaneurysm of the gastroduodenal artery; C, D: Selective angiogram of the celiac axis (C) and gastroduodenal artery (D) reveal the filling of the aneurysm from the main trunk; E: Coil embolization was performed to fill the aneurysm cavity and cause complete occlusion.

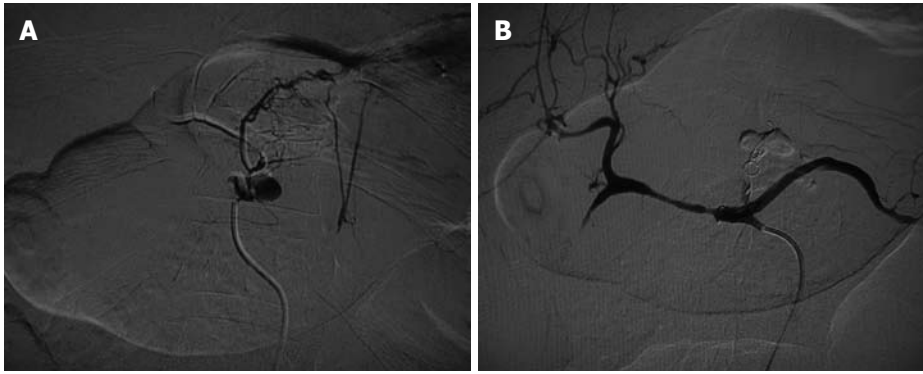


Figure 6 Endovascular coil embolization of a left gastric artery causing upper gastrointestinal hemorrhage. A: Selective angiogram of the left gastric artery shows the large saccular aneurysm; B: Selective angiogram of the celiac axis after coil embolization revealed complete non-opacification of the left gastric artery aneurysm.

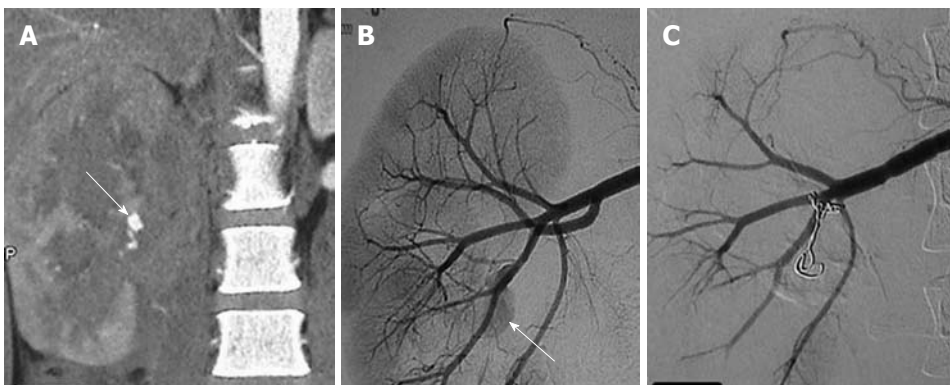


Figure 7 Traumatic right renal pseudoaneurysm. A: Coronal maximum intensity projection computed tomography angiographic image reveals a large renal midpolar laceration and a pseudoaneurysm (arrow); B: Selective angiogram of the main right renal artery reveals a pseudoaneurysm (arrow) arising from one of the posterior branches; C: Successfully occluded using coil.

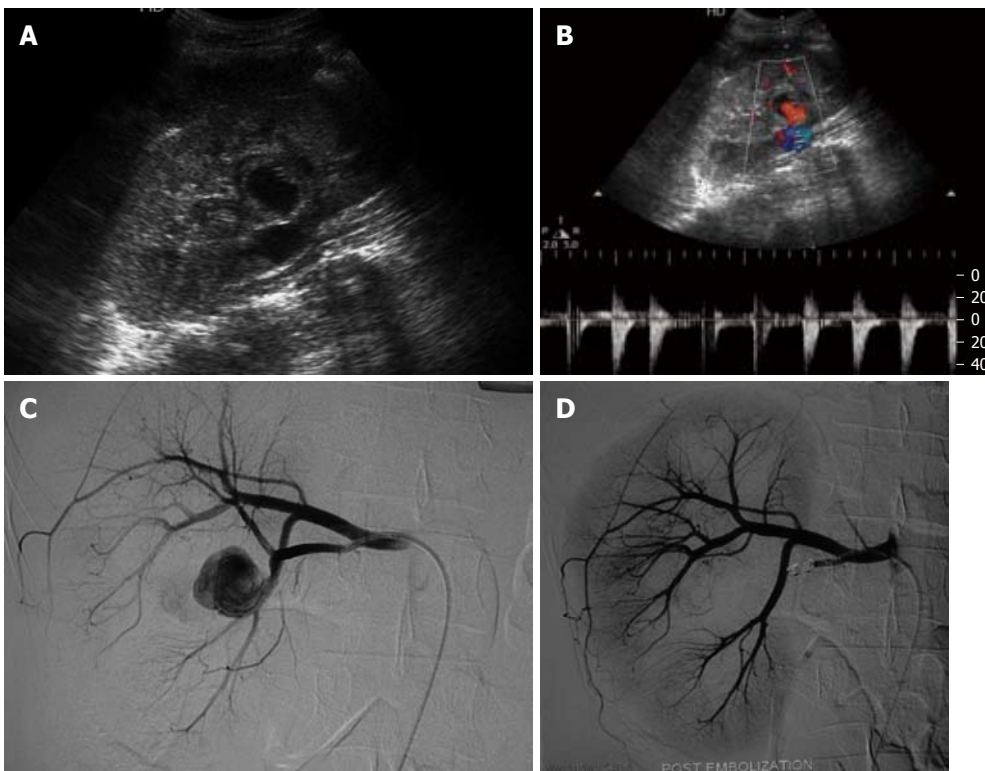


Figure 8 Traumatic right renal artery pseudoaneurysm. A, B: Grey scale ultrasound (A) and Doppler ultrasound (B) of the right kidney reveal a pseudoaneurysm in the midpolar region; C, D: Selective angiogram (C) of the right renal artery shows the pseudoaneurysm which was successfully coil-embolized (D).

made up by the gastroduodenal and right gastric arteries. Intrahepatic aneurysms can be treated by embolization^[5].

SMA ANEURYSM

The most common cause of SMA aneurysms is infection secondary to infective endocarditis or in the setting of drug abuse. Unlike other VAAs, SMA aneurysms are symptomatic and are more likely to become thrombosed than to rupture. Usually located in the proximal SMA, they present with mesenteric ischemia^[2]. The conventional treatment is surgical, but endovascular treatment (stent, coil) has also been successful^[2] (Figure 4).

CELIAC ARTERY ANEURYSMS

Celiac artery aneurysms (CAAs) are frequently symptomatic, and have high complication and mortality rates. They are usually fusiform and arise from the distal third of the trunk. A few cases of CAAs arising from anomalous common celiomesenteric trunk have been reported^[6]. Association of CAAs with other splanchnic and abdominal aortic aneurysms is relatively common.

GASTRODUODENAL AND PANCREATODUODENAL ARTERY ANEURYSMS

These are frequently related to inflammation in and around the pancreas related to acute or chronic pancreatitis (Figure 5) with erosion of the pseudocysts into the vessels. Unlike other VAAs, most are symptomatic and present as intraperitoneal, retroperitoneal or gastrointestinal hemorrhage. Coil embolization is an accepted form of treatment. When performing embolization in saccular aneurysms of the GDAs, either isolation of the aneurysm neck or both proximal and distal embolization should be performed rather than proximal embolization alone, as the aneurysm may recruit a new vascular supply in a retrograde manner.

GASTRIC AND GASTROEPIPLOIC ARTERY ANEURYSMS

Most of these are degenerative in origin and encountered in elderly men (Figure 6). They carry a very high (90%) risk of rupture into the stomach or the peritoneum and relatively high mortality rates.

RENAL ARTERY ANEURYSMS

Renal artery aneurysms (RAAs) are distinct from other VAAs, in that they have a low risk of rupture with resultant low mortality rates and frequent association with hypertension, though the cause and effect relationship with hypertension is unclear^[7]. RAAs are among the most common VAAs (Figures 7 and 8). They are more common in females, with fibromuscular dysplasia being the most common etiology, and atherosclerosis, vasculitis and trauma being the other common causes. The most common location is outside the renal parenchyma at the primary or secondary bifurcation. They are frequently saccular and calcification is rare.

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