Management of splanchnic arterial aneurysms - a case series

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Abstract:

Splanchnic arterial aneurysms remain an infrequent clinical entity although the increased utilization of different imaging modalities has raised their detection rate within the last decades. In this study, we describe a small case series including two hepatic artery aneurysms, two splenic artery aneurysms and one gastric artery aneurysm that were treated at a Hellenic University Department. They are associated with a high rupture risk and a high mortality when ruptured. It is very important to promptly treat these aneurysms when symptomatic. There is no high-level recommendation for their treatment when they are still asymptomatic. Open surgery is usually selected for ruptured or unstable cases. However, endovascular repair may be preferred for stable cases when the anatomy of the arterial tree is favorable or for patients of increased surgical risk.

***Keywords**: splanchnic aneurysms, visceral aneurysms, arterial aneurysms, treatment*

INTRODUCTION

Visceral or splanchnic arterial aneurysms are quite rare, with an estimated incidence of 0.1%-2% in the general population.[1] However, the increased utilization of ultrasound or cross-sectional body scanning for the diagnosis of intra-abdominal pathologies has raised their incidence within the last decades. The most commonly affected arteries include the splenic (60%), hepatic (20%), superior mesenteric (5%), celiac (4%), gastric and gastroepiploic (3%), intestinal (2%), pancreaticoduodenal (1%), and others (5%).[2] The most frequently reported causes include atherosclerosis, fibromuscular dysplasia, or hereditary diseases such as Marfan-or Ehlers-Danlos syndrome.[3,4] However, abdominal trauma and the increasing use of laparoscopic or endovascular techniques recently have raised the incidence of visceral arterial pseudoaneurysms.[5] It has been suggested that approximately 20% of visceral aneurysms rupture with a mortality rate of 20%-100%.[6] However, the rupture risk for pseudoaneurysms rises up to 70% due to the lack of arterial wall.[4,6]

Traditionally, small asymptomatic splanchnic aneurysms (<2cm) that were incidentally detected were managed with close surveillance and early elective repair in certain subgroups of higher rupture risk such as females of reproductive age.[1,7,8] Symptomatic or ruptured aneurysms led to an emergency open procedure in the past although endovascular repair has gained popularity within the last decades with satisfying results.[9] The recent ESVS (European Society of Vascular Surgery) Guidelines on the management of mesenteric vascular diseases recommend prompt treatment of symptomatic aneurysms although the recommendations on the treatment of asymptomatic aneurysms or the type of repair are of lower strength.[10] Furthermore, the natural history of these aneurysms is difficult to be established due to the limited number of case series, and there is still no clear consensus regarding precise indications for repair or the proper type of treatment.

Therefore, our aim is to report a small case series of visceral arterial aneurysms treated at a Hellenic University Department and to discuss on proper management.

METHODS

We retrospectively collected data referring to patients treated in our Department for splanchnic arterial aneurysms within the last 5 years. Splanchnic artery aneurysms are defined as aneurysms involving branches of the celiac, superior or inferior mesenteric artery.[9] Baseline characteristics of patients, location of the aneurysm, clinical presentation, treatment, outcome and follow-up are reported. Patients with mesenteric venous aneurysms or renal arterial aneurysms were excluded. Only patients presenting with symptoms or asymptomatic patients with aneurysms eligible for treatment were included. As a rule, aneurysms over 2cm in diameter or pseudoaneurysms of any size were eligible for treatment. Follow-up included clinical examination at regular intervals as well as a computed tomography angiography (CTA) at one month after treatment.

A written informed consent was obtained from all patients

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included in this retrospective study. A written approval was obtained from the Ethical Committee of our institution as well.

CASE SERIES

Within a period of 5 years, we have treated 5 cases of splanchnic arterial aneurysms. Overall there were 4 male patients (80%) and one female patient (20%). Mean age of patients was 49.4±10.1 years. The following locations of the aneurysms were recorded: hepatic artery (40%), splenic artery (40%) and gastric artery (20%). Two cases were asymptomatic, one case presented with a symptomatic pseudoaneurysm and two cases with rupture. Except for one patient, the rest of the aneurysms were true (80%). Mean diameter of the aneurysms was 3.3±0.6 cm. All basic characteristics of the cases including comorbidities and treatment are presented in Table 1.

One case with a ruptured aneurysm of the right gastric artery was treated endovascularly with embolization using cyanoacrylate glue. One case with an asymptomatic aneurysm of the splenic artery was treated with laparoscopic ligation of the artery and removal of the spleen as it was too close to the splenic hilum. The rest of the patients (60%) were treated with an open procedure. (Table 1) One patient with a ruptured aneurysm of the right hepatic artery was treated with aneurysmorraphy plus partial enterectomy as signs of peritonaism and instability were present. One patient with a symptomatic pseudoaneurysm of the splenic artery underwent ligation of the artery proximally and removal of the spleen after proximal clamping of the aorta under the diaphragm as the aneurysm extended also up to the splenic hilum. Finally, the last patient with an asymptomatic aneurysm of the left hepatic artery near the hepatic hilum underwent resection of the aneurysm and interposition of a short PTFE graft to preserve distal perfusion. 30-day complications, length of hospital stay and ICU (intensive care unit) stay are reported in Table 2. After a mean follow-up of 2.4± 1.3 years, all patients remain asymptomatic. All imaging was uneventful at one month.

DISCUSSION

This case series shows that both open and endovascular treatment could yield satisfying results in patients with symptomatic or asymptomatic splanchnic arterial aneurysms when selected properly.

Splenic artery aneurysms (SAAs) account for almost 50% to 75% of all visceral arterial aneurysms.[11] They may be associated with other intra-abdominal aneurysms involving visceral (3%) and renal (14%) arteries, such as in one of our cases.[9,12] Although they present with a female to male predominance of 3-4:1 and they are associated with multiparity, our two cases were equally distributed among the two genders.[9] The most common causes are arteriosclerosis and portal hypertension although our two cases included a patient with polyarteritis nodosa and a case with a pseudoaneurysm.[9,13] Pseudoaneurysms at this location are usually caused by chronic pancreatitis or by trauma although the cause in our patient was not clear.[4] With more than 95% of aneurysms in pregnant females being diagnosed after rupture, rupture rates range around 10% in most of the observational studies.[4,11,14] Hence, none of the two cases presented with rupture in our series.

Number of case	Gender	Age	Location of aneurysm	Symptoms	Type/Size of aneurysm	Comorbidities	Anticoagulant treatment	Treatment	Follow-up
1.	Male	34	Right hepatic artery	Rupture, renal infarcts	True/ 3.5 cm	Polyarteritis nodosa, Smoking Other aneurysms: splenic, both renal arteries	-	Aneurysmorraphy plus partial enterectomy	1 year
2.	Male	76	Right gastric artery	Rupture	True/ 3 cm	Hypertension	-	Endovascular embolization with glue	5 years
3.	Male	45	Splenic artery	Abdominal pain	Pseudoaneurysm/ 4.5cm		-	Open ligation of the splenic artery and splenectomy	2 years
4.	Male	58	Left hepatic artery	Asymptomatic	True/2.5cm	-	-	Aneurysm resection and PTFE graft interposition	3 years
5.	Female	60	Splenic artery	Asymptomatic	True/ 3cm	Hypertension	-	Laparoscopic ligation of the splenic artery and splenectomy	1 year

Table 1

Number of case	Gender	Location of aneurysm	30-day complications	ICU stay (days)	Hospital stay (days)
1.	Male	Right artery	Temporal renal dysfunction and rise of hepatic enzymes	4	10
2.	Male	Right gastric artery	None	0	5
3.	Male	Splenic artery	Respiratory infection in the ICU	4	8
4.	Male	Left hepatic artery	Temporal rise of hepatic enzymes	3	10
5.	Female	Splenic artery	Left Pleural effusion that needed evacuation	3	9

ICU, intensive care unit

Table 2

Regarding treatment, ruptured SAAs should be promptly treated.[10,14] Most of the authors suggest that an asymptomatic aneurysm of 1 to 2 cm in diameter should be closely monitored with imaging studies every 6 months.[11,14,15] However, elective repair is recommended when the aneurysm grows fast or exceeds 2 cm[10]. Especially in pregnant women or women of childbearing age, the indication may include aneurysms of any size due to the high risk for rupture.[10,11] Mortality remains high in cases with rupture and reaches 40% although elective cases are associated with low mortality and morbidity.[16]

The location of the SAA as well as its presentation dictates the type of procedure that is performed. Surgical repair is preferred for all symptomatic aneurysms because of the greater likelihood of success.[14,16] Resection with end to end anastomosis can be performed in many cases, due to the predominantly proximal location of SAAs and to the redundancy and tortuosity of the artery.[11,17] This usually allows for splenic preservation, which is important for the immune system. However, aneurysms involving the splenic hilum usually require splenectomy such as in our two cases, although this is performed more commonly when the aneurysm is ruptured.[11,14] Transcatheter embolization with either coils or glue (N-butyl cyanoacrylate) is particularly appropriate for saccular aneurysms or fusiform aneurysms with good collateral flow to the end organ, except those located at the splenic hilum.[18,19] In cases of portal hypertension, transcatheter embolization or stent-graft placement may be preferred because the extensive collateral circulation complicates surgery.[20] In case of pseudoaneurysms, splenectomy still remains the standard of treatment although endovascular repair is gaining popularity.[21] Finally, we preferred a laparoscopic approach in one of our cases as it avoids large incisions in younger patients and the morphology of the aneurysm prohibited an endovascular repair.[22]

Hepatic arterial aneurysms (HAAs) are the second most frequent visceral arterial aneurysms, with almost half of them being pseudoaneurysms.[1,14] The increasing performance of percutaneous biliary procedures, non-operative management of trauma, and liver transplantations has led to an increasing incidence of hepatic artery pseudoaneurysms.[23] However, both our HAA cases were true aneurysms. True aneurysms occur 4 times more frequently in the extrahepatic arteries, concurring with our cases. Regarding pathogenesis, they are associated mainly with arteriosclerosis and acquired medial degeneration.[14] Most of the HAAs are identified incidentally while performing CT scanning or ultrasound examination although one of our cases presented with rupture.[24] When ruptured, clinical presentation more frequently includes jaundice, biliary colic, and gastrointestinal hemorrhage rather than a free, intraperitoneal rupture.[14,24] According to centers with large experience, indications for treatment of HAAs include symptomatic aneurysms, non-atherosclerotic aneurysms, multiple aneurysms, and aneurysms >2 cm in good-risk patients with a life expectancy of at least 2 years, concurring with our strategy.[23]

Surgical treatment of HAAs depends on the location of the aneurysm, presence of collateral flow, and health status of the patient. Vascular reconstruction is usually needed for aneurysms involving the proper hepatic artery although asymptomatic HAAs located at the common hepatic artery may be managed without reconstruction if collateral flow through the gastroduodenal artery or right gastric arteries is adequate.[9,23] However, to prevent hepatic infarction, ligation or embolization of the aneurysm is best performed only if the portal vein is patent.[9,25] Additionally, endovascular repair including embolization or stent-graft placement may be used in patients of higher surgical risk with satisfying results.[6,26] In a systematic review by Kok et al., technical success was 100% and visceral preservation 94.7% for patients treated endovascularly for splanchnic aneurysms.[6] Especially for intrahepatic aneurysms, percutaneous embolization is considered a first-line treatment due to the complicated nature of open repair.[9] Finally, percutaneous approaches appear to be particularly useful in the treatment of hepatic artery pseudoaneurysms, where there is a history of previous abdominal surgery and severe comorbidities.[27]

Finally, gastric artery aneurysms are less frequent with an estimated incidence of 3-4%.[9] Specifically, the incidence of right gastric artery aneurysms is estimated to be 0.001%.[28] They are usually detected in male patients in the 6th or 7th decade of their lives, concurring with our case.[28] Although the asymptomatic aneurysms remain undetected in their majority, symptomatic aneurysms present with rupture in almost 90% of the cases.[29] Treatment depends on the condition and clinical presentation of the patient. In cases of rupture and hemodynamic instability, a laparotomy followed by ligation of the artery is indicated.[30] Endovascular treatment including embolization or stent-grafting remains an option for stable or asymptomatic patients and cases of high risk for open surgery.[28,31] However, stent-grafting is often difficult due to tortuosity of the vessel or due to small diameter.[28] Recently, the use of multilayer flow modulator (MFM) stent has also been described for visceral aneurysms with narrow necks.[32] However, their use in patients with rupture or bleeding should be avoided as they convert the blood stream into the sac from turbulent to laminar, without fully occluding it.

In conclusion, splanchnic artery aneurysms although infrequent are associated with a high rupture and mortality rate. Therefore, they should be promptly treated when they fulfill the aforementioned indications. Open surgery is usually selected for ruptured or unstable cases. However, endovascular repair may be preferred for stable cases when the anatomy of the arterial tree is favorable or for patients of increased surgical risk.

No conflict of interest.

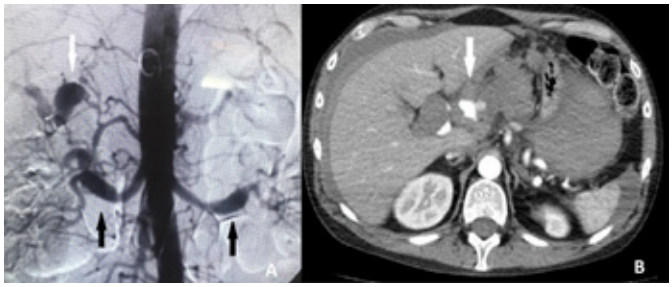

Fig 1. (A) Digital subtraction angiography (DSA) of case 1 showing the aneurysm of the right hepatic artery (white arrow) as well as aneurysm of both renal arteries (black arrows). (B) Computed tomography angiography (CTA) of the same patient showing the ruptured aneurysm with the perianeurismal hematoma. (arrow)

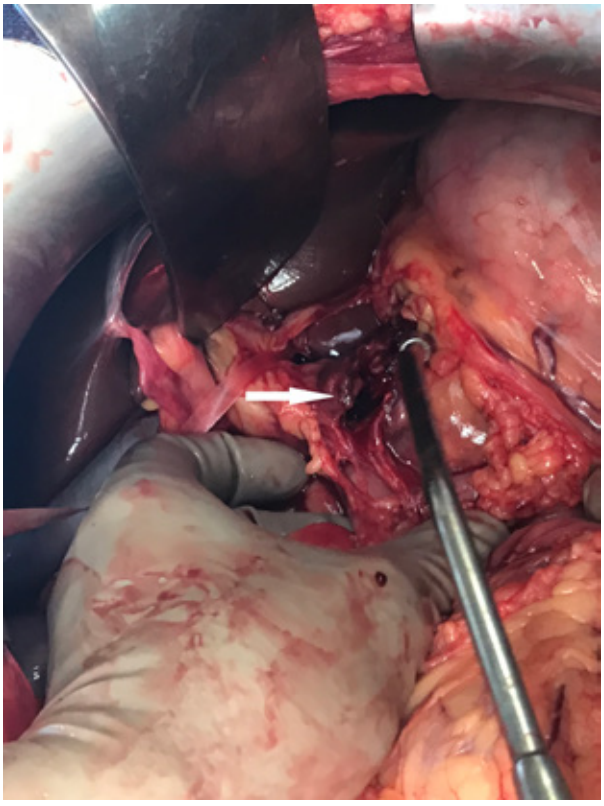

Fig 2. Intraoperative image of case 1 showing the location of the rupture (arrow).

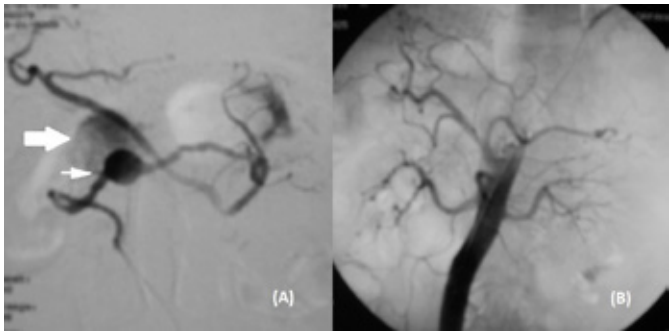

Fig 3. (A) Digital subtraction angiography (DSA) of case 2 showing a ruptured aneurysm of the right gastric artery (thin arrow) with extravasation (thick arrow). (B) DSA from the same patients after the endovascular embolization. There is no sign of the aneurysm or any bleeding.

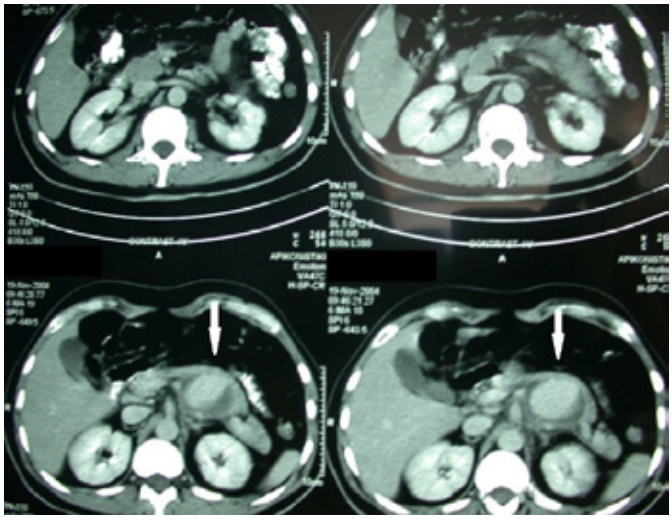

Fig 4. Computed tomography angiography (CTA) of case 3 showing a large pseudoaneurysm of the splenic artery (arrows).

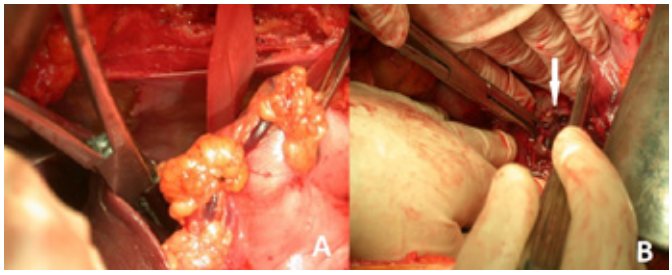

Fig 5. (A) Intraoperative image of case 3 showing the vascular clamp located just under the diaphragm. (B) Intraoperative image of the same patient showing the ruptured artery (arrow).

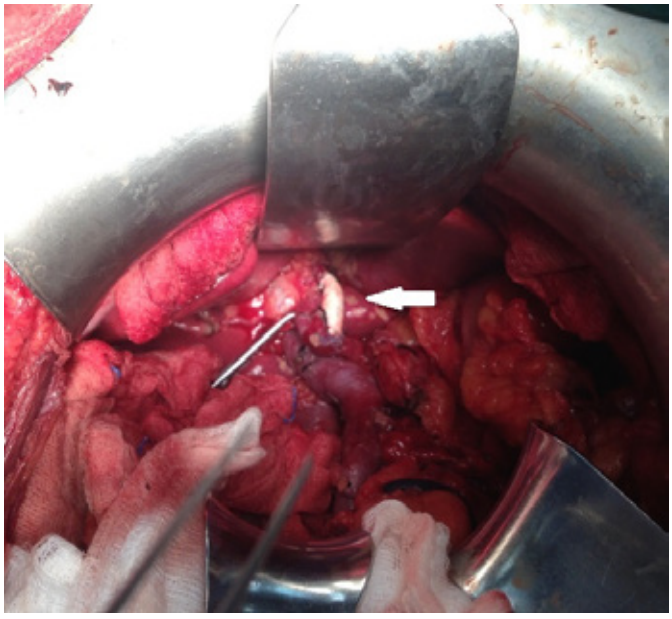

Fig 6. Intraoperative image of case 4 showing the interposition of a synthetic PTFE graft (arrow) after resection of a left hepatic artery aneurysm.

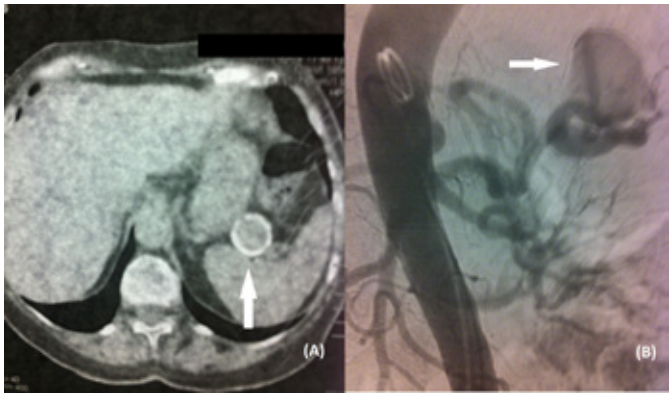

Fig 7. (A) Computed tomography angiography (CTA) of case 5 showing an atherosclerotic aneurysm of the splenic artery. (B) Digital subtraction angiography (DSA) of the same patient showing the aneyrysm (arrow) at the splenic hilum as well as the tortuosity of the splenic artery.

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