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Visceral artery pseudoaneurysms: An institutional experience

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Abstract

Purpose: Visceral artery pseudo-aneurysms were infrequently encountered in clinical practice. With the advent of higher resolution imaging, VAPA has been diagnosed more frequently and promptly. Though the natural history of this pathology is not fully elucidated, they can present with devastating complications. This study is one of the few large case series exclusively describing visceral artery pseudo-aneurysm offering a glimpse in to various etiologies, presentations, and treatment approaches for visceral artery pseudo-aneurysms in a specialized care center.
Material and Methods: Medical records of patients with visceral artery pseudo-aneurysms between January 2015 to May 2020 were retrieved, and data pertaining to etiology, clinical presentation, imaging, and management were compiled and analyzed.
Results: During the study period 29 visceral artery pseudo-aneurysms were identified in 27 patients (2 patients had more than one VAPA). They had diverse etiology, location, and presentation. The splenic artery was the most common site of VAPA (n=10). The commonest etiology was pancreatitis (41%). Only 7 patients were asymptomatic while the majority had symptoms (n=20). Abdominal pain was the most frequent symptom (66%) followed by gastrointestinal bleeding (30%). 16 patients were successfully treated by endovascular intervention, while 2 patients required surgical intervention. No morbidity or mortality was noted during the period of hospitalization.
Conclusion: Visceral artery pseudo-aneurysms can be secondary to plethora of pathologies. A high degree of suspicion with prompt imaging helps in timely diagnosis. Endovascular interventions are highly effective treatment modalities for visceral artery pseudo-aneurysms. It should be considered as the preferred modality of treatment in anatomically suited VAPA.

Keywords: Visceral artery, pseudo-aneurysm, aneurysm, endovascular intervention

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Abbreviations: VAPA-Visceral artery pseudoaneurysm, DUS-Duplex ultrasonography.

1. Introduction

Visceral artery pseudo-aneurysms (VAPA) are limited to coeliac artery, superior and inferior mesenteric artery, and their branches [1]. Though the natural history of this disease has not been fully elucidated, it poses a significant risk for complications not limited to rupture. This study is one of the few large case series describing the clinical experience of visceral artery pseudo-aneurysms. With the increasing use of high-definition imaging like triple-phase computed tomograms, clinicians are increasingly becoming aware of this sinistral entity. We aim to provide a comprehensive account of various aspects of visceral artery pseudo-aneurysms with a focus on etiology and treatment.

2. Materials and Methods

During the study period between January 2015 and May 2020, 29 visceral artery pseudo-aneurysms were identified in 27 patients (2 patients had more than one VAPA). These patients' demographic details and clinical data were obtained from hospital records. Our study includes patients diagnosed with pseudoaneurysm of arteries supplying the visceral organs, which includes celiac artery, superior mesenteric artery, inferior mesenteric artery, and its branches. Diagnostic imaging included DUS and computed tomographic angiography (CTA). All patients with pseudo-aneurysms were counseled and offered treatment. Any amount of bleeding in pseudoaneurysm was considered as an indication for urgent intervention.
Treatment modalities included endovascular coiling and surgery. In endovascular repair, coils were packed into the distal portion, followed by proximal artery, thus excluding the aneurysm. In cases where blood flow persists coiling of the aneurysm sac was considered. No other endovascular (stent placement) or laparoscopic techniques were employed. The procedure is considered complete if the aneurysm sac is thrombosed or successfully occluded. Patient refusing for intervention were also included to understand the etiopathogenesis. All the data were tabulated in an Excel spreadsheet and analysis of data was made using the Chi-square test.

3. Results

29 visceral artery pseudo-aneurysms were identified in 27 patients (2 patients had more than one VAPA).The majority of the patients were male (n=17). The youngest patient in our series was 17 years old, and the oldest patient was 68 years. The average age of our study population was 46.3years. Males outnumbered females with a ratio of 1.7 to 1. Most of the patients (n=20) were symptomatic. In the 7 asymptomatic patients, pseudo-aneurysms were discovered during surveillance imaging. Abdominal pain (66%) was the most common symptom. Gastrointestinal tract bleeding in the form of hematemesis or melena was seen in 30% of the cases.
The anatomical distribution of the visceral artery pseudoaneurysms in our series is illustrated in Table 1. The highest incidence was seen in splenic artery (45%) followed by gastroduodenal artery (14%).Pancreatitis (41%) was found to be the most common cause for VAPA. Peptic ulcer disease (20.6%), trauma, operative procedure, median arcuate ligament syndrome, and autoimmune disease were the other reasons, as shown in Table 2.
18 patients in our series underwent treatment, while 9 patients refused any kind of intervention. 16 patients accounting for 18 pseudoaneurysms underwent endovascular repair by embolization of the feeding artery and sac packing with detachable coils. One patient required USG guided lipiodol injection apart from the endovascular coiling. 2 patients

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required surgery in the form of ligation of feeding vessel and repair of vessel wall. Table 3 summarizes the information pertaining to the interventions. The patients had an uneventful recovery with no morbidity or mortality during the period of hospitalization.

4. Discussion

Visceral artery pseudoaneurysms are considered a relatively rare but potentially lethal entity. A pseudoaneurysm results when a wall defect leads to the formation of an extravascular hematoma which communicates with the intravascular space. There is evidence of very high risk of spontaneous rupture of pseudo-aneurysms [2]. In our institute, 27 patients with 29 pseudo-aneurysms were identified during a period of 5 years. Timely identification and appropriate treatment can significantly decrease the mortality and morbidity by preventing aneurysm rupture into the peritoneal cavity, hepatobiliary and gastrointestinal tract. This emphasizes on early detection and treatment of VAPA.

Pseudoaneurysms differ from true aneurysms in having a well-documented underlying pathology. In our series, pancreatitis accounted for a significant proportion of pseudoaneurysms (41%), followed by peptic ulcer disease (20.6%). Other rare causes for VAPA in our series included trauma, operative procedures, median arcuate ligament syndrome, and autoimmune disease. We presume that the proteolytic enzymes released from the pancreas during pancreatitis plays a critical role in the pathogenesis of pseudo-aneurysms. Peptic ulcers erode into the pancreas and splanchnic arteries resulting in pseudo-aneurysms and subsequent rupture. Blunt abdominal traumas and iatrogenic injuries after hepatobiliary surgery have also contributed to development of pseudo-aneurysms. Compression of celiac artery in median arcuate ligament syndrome results in decreased blood supply to the liver and spleen with a compensatory increase in blood flow thorough superior mesenteric artery. This could explain the pseudo-aneurysm of the superior mesenteric artery in our patient with median arcuate ligament syndrome. In our series, a postpartum lady suffering from an autoimmune disease (Antiphospholipid syndrome) was diagnosed with uterine artery pseudoaneurysm following postpartum hemorrhage.

Out of 27 cases, 17 were male, and the mean age was 46.3 (range 17-68). One case of pediatric age group was diagnosed following a blunt abdominal trauma. Abdominal pain was frequently seen in unruptured visceral artery pseudoaneurysm, while gastrointestinal hemorrhage was found in case of ruptured pseudoaneurysm [4]. Depending on the site of involvement, a patient can present with hematemesis, melena, hemosuccus pancreaticus, and hemorrhagic shock. Bleeding in pseudoaneurysm results due to continuous pressure necrosis caused by expanding pseudoaneurysm. This leads to recurrent damage and sloughing off of the aneurysm through the duodenal wall, common bile duct, pseudocyst, or duct of Wirsung. Other symptoms though uncommon, are jaundice, vomiting, and fever. In our study, 24% of ruptured VAPA presented with abdominal pain and anemia. In the absence of obvious signs of shock, rupture can be clinically missed and can result in a calamitous ending.

According to Ikeda et al., contrast-enhanced CT is the investigation of choice for diagnosis of VAPAs [3]. CTA additionally helps to identify the site of pseudo-aneurysms, localize donor arteries, and determine the neck of pseudo-aneurysms. This helps to not only diagnose VAPA early but to plan treatment quickly. All the patients in this series were evaluated by contrast-enhanced computed tomography. Splenic artery involvement was seen in 44.8%, followed by gastroduodenal in 13.7%, consistent with other studies. Other visceral arteries like the coeliac artery, superior mesenteric artery, right hepatic artery, accessory hepatic artery, portal vein, uterine artery, and right gastric artery were also involved. This distribution can be attributed to the etiologies that is seen in our study, 41% of our patients suffered from pancreatitis and 20.6% from peptic ulcer disease.

The modality of treatment was decided based on the dimension of the pseudo-aneurysm.

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According to guidelines, a pseudoaneurysm is considered an emergency as the incidence of rupture is higher in pseudo-aneurysms than true aneurysms (76.3% versus 3.1%) [5]. The goal of treatment in visceral artery pseudoaneurysm is to preserve the distal flow of the artery while excluding the pseudoaneurysm from the circulation.

Different treatment modalities include surgery (arterial bypass, vessel ligature, exclusion of the aneurysmal sac), percutaneous (thrombin injection), or endovascular (embolization, stent placement) interventions. Although VAPAs can be treated by ligation or embolization since collaterals are almost always present between the visceral arteries, an end-organ might be supplied by a single vessel. In such cases, utmost care should be taken to preserve the patency of the parent vessel either through stent placement or surgical revascularization. There has been an increasing tendency to treat the VAPA by endovascular approach.

Sachdev *et al*. have suggested that in hemodynamically unstable patients, previously attempted endovascular repair or anomalous anatomy, does not preclude the use of endovascular treatment. Hence, endovascular repair was the intervention of choice in our cases [6]. Embolization was successfully done for 18 pseudoaneurysms while 2 patients underwent a surgical procedure. Technical success was achieved in all of our interventions which is in agreement with other recent reports documenting better success rates with the endovascular management of VAPA [3].USG guided thrombin injection is another modality that was used as an adjunct for a case post endovascular coiling. The early post-injection period of thrombin has a lower risk of distal embolization and recanalization. Therefore, it is a suitable treatment modality for a pseudoaneurysm with a small neck and relatively slower flow. However, the disadvantage of thrombin is that it is radiolucent and distal embolization may not be recognized during the procedure [7]. Following endovascular therapy, access-site hematoma, pain, cellulitis or infection, and technical failure to catheterize the artery are documented side effects associated with the procedure. Other potential complications include distal thromboembolism, nontarget embolism, coil or stent migration, stent occlusion, visceral ischemia, post-embolization syndrome, intraprocedural pseudoaneurysm dissection, or rupture. While late complications include reperfusion or recurrent bleeding of a pseudoaneurysm.

5. Conclusion

VAPA although rare, is an important entity to be kept in mind because of its catastrophic complications and better outcomes when treated early. A high degree of suspicion in clinical settings like pancreatitis, peptic ulcer disease, trauma, and postoperative state (particularly following liver and pancreatic surgery) should prompt appropriate imaging like contrast-enhanced computed tomography. Endovascular intervention should be considered as the preferred modality of treatment in anatomically suited VAPA.

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7. Appendices

Table 1: Types of VAPA and cause

Type of VAPA	Number of cases (%)	Sex (M/F)	Cause of VAPA
Splenic artery	13 (44.8)	10/3	Pud- 4 Pancreatitis- 7 Trauma- 1 Unknown- 1
Accessory hepatic artery	1 (0.3)	1/0	Pancreatitis- 1
Right hepatic artery	2 (0.6)	1/1	Trauma-1 Post-surgery (whipple's)-1
Coeliac artery	2 (0.6)	2/0	Pud-1 Unknown-1
Gastroduodenal artery	4(13.7)	2/2	Pancreatitis-3 Infection-1
Pancreaticoduodenal	2 (0.6)	0/2	Pancreatitis-1 Unknown-1
Superior mesenteric artery	2 (0.6)	1/1	Pud-1 Median arcuate ligament syndrome-1
Uterine artery	1 (0.3)	0/1	Autoimmune disorder-1
Portal vein	1 (0.3)	0/1	Infection-1
Right gastric artery	1 (0.3)	1/0	Pud-1

Table 2: Patients' demographics and characteristics of VAPA

Data	Male (17/27)	Female (10/27)	Average (range)
Age	43.1 (17-67)	51.6 (30-68)	46.3 (17-68)
Diameter			
ETIOLOGY			
Pancreatitis	9	3	12
Pud	5	1	6
Trauma	2	0	2
Postoperative	0	1	1
Autoimmune dysfunction	0	1	1
Infection	0	2	1
Median arcuate ligament syndrome	0	1	1
Unknown	1	1	3
Symptomatic without rupture	10	6	16

Rupture with hemorrhagic shock	3	1	4
Rupture not in shock	4	3	7
Location			
Splenic artery	10	3	13
Accessory hepatic artery	1	0	1
Right hepatic artery	1	1	2
Coeliac artery	2	0	2
Gastroduodenal artery	2	2	4
Pancreaticoduodenal	0	2	2
Superior mesenteric artery	1	1	2
Uterine artery	0	1	1
Portal vein	0	1	1
Right gastric artery	1	0	1

Table 3: Intervention for VAPA

VAPA location	Intervention					
	Embolisation		Surgery		Non-compliance to treatment	
	R	Ur	R	Ur	R	Ur
Splenic artery	1	7	0	1	0	4
Accessory hepatic artery	1	0	0	0	0	0
Right hepatic artery	2	0	0	0	0	0
Coeliac artery	1	0	0	0	0	1
Gastroduodenal artery	2	2	0	0	0	0
Pancreaticoduodenal	1	0	0	1	0	0
Superior mesenteric artery	0	0	0	0	0	2
Uterine artery	0	0	0	0	1	0
Portal vein	0	0	0	0	0	1
Right gastric artery	1	0	0	0	0	0
Total	9	9	0	2	1	8

7.2 Figure caption

7.2.1 Angiogram and transcatheter arterial embolization (A) Splenic artery angiography shows a pseudoaneurysm (arrow). (B) Angiogram of splenic artery aneurysm after distal coil embolization. (C) Angiogram of splenic artery aneurysm after proximal coil embolization. (D)

7.2.2 Angiogram of the splenic artery aneurysm after coil embolization. (A) Axial contrast-enhanced image of the arterial phase shows pseudoaneurysm arising from right hepatic artery (black arrows) (B) pseudoaneurysm in the territory of the replaced right hepatic artery (C) Volume-rendered image gives a three-dimensional overview of the pseudoaneurysms arising from the right hepatic artery.

7.2.3 Digital subtraction angiogram (DSA) images. (A) Selective replaced right hepatic artery DSA shows pseudoaneurysms (B) DSA after coil embolization shows non-filling of the pseudoaneurysms (C) DSA of the hepatic artery after coil embolization shows non-filling of the pseudoaneurysm

7.2.4 Contrast-enhanced abdomen computed tomography (A) Axial section shows a pseudoaneurysm measuring 20x17mm approx. from the proximal superior mesenteric segment (B) Sagittal section shows a large non-enhancing hematoma due to bleed from pseudoaneurysm, with a branch from superior mesenteric artery traversing the hematoma. (C) Transverse section showing the pseudoaneurysm.

Ethical approval: This study was performed as a retrospective audit and approved by the hospital research and innovation office. Formal ethical approval was not sought given the retrospective nature of the data review.

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