

Original Article

Managing Splenic Artery Pseudoaneurysms— An Experience from a Developing Country. A Retrospective Review

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Objectives: Splenic artery pseudoaneurysm is a rare but potentially fatal condition. Early diagnosis and intervention are the key steps in the management of this condition. We have reviewed our institution's 4-year data regarding the presentation and management of this condition.

Methods: We conducted a prospective review of the records of 10 patients who presented to our institute from January 2018 to December 2021 with a splenic artery pseudoaneurysm. We found one patient with a true aneurysm, whom we excluded from the study.

Results: This study included seven male and two female patients with a mean age of 47.7 years. Six patients presented to the emergency department with bleeding secondary to rupture aneurysm, which is the most common reason for admission. Pancreatitis was found to be the most common cause for splenic artery pseudoaneurysm (five patients). Computed tomography angiogram remained the modality of choice for diagnosing splenic artery pseudoaneurysm. All patients were successfully managed with endovascular intervention.

Conclusion: Splenic artery pseudoaneurysm is usually a rare complication of pancreatitis, which is associated with high morbidity and mortality. Timely diagnosis and intervention are the keys to successful management. Endovascular embolization should be the first-line therapy in splenic

artery pseudoaneurysm.

Keywords: splenic artery pseudoaneurysm, embolization, pancreatitis

Introduction

The splenic artery is the most affected visceral artery (approximately 60%) and the third most common intra-abdominal artery to be affected by aneurysmal degeneration.¹ It has been reported in approximately 1% of the normal population¹ and has an incidence of 10.4% in postmortem examinations.² A true aneurysm encompasses all layers of the vessel wall, whereas a pseudoaneurysm is caused by a disruption of the arterial wall followed by a periarterial hematoma. Splenic artery pseudoaneurysm is rare with <200 cases reported in the literature.³

Splenic artery true aneurysms remain asymptomatic and rarely rupture (10%).⁴ Conversely, pseudoaneurysms are almost always symptomatic, in which rupture with hemorrhagic shock is the most common presentation.⁵ This is reported in as much as 37% of patients, leading to death, if untreated, in nearly 90% of cases.⁶ Therefore, a high degree of suspicion, timely identification, and prompt treatment are crucial in the successful management of this condition.

Treatment options include open surgical technique with the repair of splenic artery pseudoaneurysm and ligation of artery or splenectomy, transabdominal percutaneous thrombin or glue injection, and endovascular embolization techniques. In a review published in 2003, Tessier et al. recommended a surgical approach with the repair of pseudoaneurysm and splenectomy as a more durable approach for managing splenic artery pseudoaneurysm, especially in the presence of a pseudocyst.³ However, with recent advancements and better availability, the endovascular approach has become increasingly popular and the initial treatment of choice. The literature from the last decade has reported that the endovascular approach using embolization techniques and stents has an efficacy of 88%–100% and perioperative mortality of zero (0%).^{7–9}

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Splenic artery pseudoaneurysm is a rare condition with little literature reported regarding its management in resource-limited developing countries. To achieve ideal outcomes, spreading knowledge regarding its early identification based on presentation and radiological investigations, prompt diagnosis, and timely intervention is essential. To fulfill this objective, we are reporting our experience of splenic artery pseudoaneurysms at the Aga Khan University Hospital, one of the busiest tertiary care university hospitals in Pakistan.

Materials and Methods

This was a prospective review of patients' records, performed in the Department of Surgery at Aga Khan University Hospital, Karachi, Pakistan, from January 2018 to December 2021. The study was reviewed by the departmental (DRC) and ethical committee (ERC) of the university (ERC number 2021-6184-17643). All adult (>18 years) patients who presented to our institute with splenic artery pseudoaneurysm were included in our study. The diagnosis of pseudoaneurysm was made on the basis of history, examination, and computed tomography (CT) angiographic findings. All the CT angiograms were prospectively reviewed by a qualified vascular radiologist. All demographic data, history, comorbid conditions, clinical presentation, radiological findings, interventions, and outcomes were reviewed. Patients were observed for 30 days and any readmissions and reinterventions were recorded. All statistical analyses were performed using SPSS (SPSS Inc., Chicago, IL, USA). A p-value of <0.05 was considered significant.

Results

Using International Classification of Diseases (ICD) (10) codes, a total of 10 records of patients with splenic artery aneurysms were retrieved. Out of these patients, nine patients with splenic artery pseudoaneurysm were identified and found eligible for this study. Seven patients were men with a mean age of 47.7 years (27–69 years). **Table 1** summarizes the demographics, clinical features, and management of all cases.

Most of the patients (n=6) presented in the emergency department. Bleeding due to ruptured pseudoaneurysm was the main presenting feature in this group of patients. Among these patients, three were hemodynamically unstable secondary to the ruptured pseudoaneurysm. Three and two patients had upper gastrointestinal bleeding and bleeding into the lesser sac, respectively. One patient who presented in the emergency department without bleeding was diagnosed with splenic pseudoaneurysm as a part of the workup for fever and left-sided abdominal pain.

Out of the remaining three patients who did not present to the emergency department, two patients developed hemorrhagic shock during their stay in the critical care unit and were found to have ruptured splenic artery pseudoaneurysm on imaging. One patient was electively admitted from the outpatient department and was diagnosed to have splenic artery pseudoaneurysms as a part of the evaluation of abdominal pain.

The causes included acute necrotizing pancreatitis (two patients), a history of acute pancreatitis (three patients), locally advanced gastric carcinoma (one patient), and iatrogenic injury (one patient). There was no identifiable cause in the remaining two patients. In all patients with acute or chronic pancreatitis, no pseudocyst was identified on imaging.

Patients with the presentation of bleeding had an average hemoglobin level of 7.9g/dL on arrival (5.7–11.3g/dL). Three patients presented with hypovolemic shock secondary to a ruptured aneurysm, out of whom, two patients bled into the omental bursa and were diagnosed within 2 h of arrival, whereas the other patient was diagnosed with a delay of 14h. Another two patients who presented with upper and lower gastrointestinal bleeding in the emergency department were diagnosed at an aver-

Table 1 Characteristics of patients presenting with splenic artery pseudoaneurysm

Characteristic	Total cases (n=9)
Mean age (range) (years)	47.7 (27–69)
Male sex (n)	7
Cause (n)	
Chronic pancreatitis	3
Acute pancreatitis	2
Iatrogenic	1
Gastric cancer	1
Idiopathic	2
Pseudocyst	0
Symptoms (n)	
Gastrointestinal bleeding	3
Hypovolemic shock	2
Abdominal pain	2
Others (blood in drains)	2
Bleeding aneurysm (n)	7
Size of the aneurysm (cm)	2.2 (0.5–4.4)
Treatment (n)	
Transcatheter embolization	9
Coil	6
Glue	1
Both	1
Splenectomy	0
Complication	
Splenic infarction	1
Mortality	2

age interval of 93 h.

The diagnosis of splenic artery pseudoaneurysm was made on a CT scan of the abdomen with contrast in all cases. The pseudoaneurysm diameter ranged from 0.5 to 4.4 cm. In patients who presented with rupture pseudoaneurysm and hypovolemic shock, the average pseudoaneurysm diameter was 1.6 cm. All patients were found to have a single pseudoaneurysm, which was located proximally along the splenic artery in five patients and distally in the remaining patients. None of the patients were found to have multiple pseudoaneurysms.

The right femoral artery was used as vascular access for intervention in all cases, and all patients underwent endovascular intervention as the first line of management and successful embolization using coils (six patients) or histoacryl glue (one patient), or a combination of both (one patient). None of the patients needed splenectomy or any other surgical management.

None of the patients developed rebleeding after embolization. One patient was found to have splenic infarction on repeat imaging performed 5 days later as a follow-up scan. However, he was managed conservatively with analgesics in an outpatient setting. Follow-up data were reviewed, and none of the patients were readmitted within 30 days. The mean hospital stay was 10.5 days. No specific protocols were followed in managing the condition.

Discussion

Splenic artery pseudoaneurysm is a potentially lethal condition with a fatality rate of up to 90% when ruptured⁵⁾ and a natural course that is not fully understood. In Pakistan, multiple case reports on pseudoaneurysms commonly involving femoral arteries, aorta, and left ventricle have been published.^{10–13)} However, data related to splenic pseudoaneurysms are lacking.

Acute and chronic pancreatitis are found to be the most common causes of splenic artery pseudoaneurysm. Similar results have been observed in our study where more than half of the patients had a history of either acute or chronic pancreatitis. The pathogenesis is attributed to the release of lytic enzymes by the pancreas that causes erosion of the vascular wall, which results in periarterial hematoma, and then in pseudoaneurysm formation.¹⁴⁾ Other causes of splenic artery pseudoaneurysms include blunt abdominal trauma, iatrogenic injury, and peptic ulcer disease.³⁾

In one of the literature reviews, bleeding was found to be the most common presenting complaint in splenic artery pseudoaneurysm with approximately 58% of patients presenting to hospitals in a hemodynamically unstable state,³⁾ as was noted in our study population as well. The pseudoaneurysms can bleed into the peritoneal cavity, retroperitoneal space, adjacent organs, or pancreatic

duct.¹⁵⁾ Bleeding into the pancreatic duct has been termed *hemosuccus pancreaticus*¹⁶⁾ and presents as hematemesis, hematochezia, or melena.

The clinical presentation of splenic pseudoaneurysm ranges from incidental finding (2.5%), abdominal pain (29.5%), abdominal distension, hematemesis (14.8%), hematochezia, and melena (26.2%) to hemorrhagic shock and collapse.³⁾ Furthermore, pseudoaneurysms usually present with rupture more often, regardless of their size. Similar results were seen in our study with more than half of the patients presenting with hypovolemic shock as a result of pseudoaneurysm rupture (55%). Therefore, it is essential to keep this intra-abdominal vascular catastrophe in the differential diagnosis of patients presenting with abdominal pain along with symptoms of hypovolemic shock.

The size of a splenic artery pseudoaneurysm is not a determinant of rupture or bleeding.⁵⁾ Similar results were obtained in our study where a pseudoaneurysm as small as 0.6 cm presented with active bleeding but a large 4.4 cm pseudoaneurysm was found incidentally in our case series.

The rare nature of these lesions with varied clinical presentations and the high tendency to rupture pose a diagnostic challenge. Prompt diagnosis and immediate intervention are key steps in the successful management of patients with splenic artery pseudoaneurysms. Direct catheter angiography has been assumed to be a gold standard for diagnosing both splenic artery aneurysms and pseudoaneurysms, with the added advantage of therapeutic intervention in selected patients. However, CT angiography has emerged as the most promising modality in identifying splenic artery pseudoaneurysm³⁾ because it is noninvasive and helps exclude alternate diagnoses. However, there are studies in which splenic artery pseudoaneurysms are disguised as pancreatic cysts, gastrointestinal stromal tumors, and renal cysts on initial imaging.^{14,17)} In such cases where ultrasound and CT scans are indefinite, conventional catheter angiography is required to confirm the diagnosis of pseudoaneurysm. All cases presented to our hospital were diagnosed to have pseudoaneurysms on CT angiogram.

The high morbidity and mortality related to splenic artery pseudoaneurysm make it mandatory to treat these lesions.³⁾ The treatment modalities include surgical, endovascular, and transabdominal interventions. Splenectomy with or without pancreatectomy had previously been the treatment of choice. However, the procedure bears a morbidity rate of 9% and a mortality risk of 1.3%.¹⁸⁾

The last decade has shown increasing evidence of success of endovascular treatment (85%).¹⁹⁾ Although corresponding with a failure rate of 10%–15%,¹⁹⁾ endovascular technique is considered a safer alternative with lower morbidity and mortality compared with open surgical procedures.^{7,18,20)} Endovascular treatment can be an

intermediate measure for hemorrhage control or can be a definitive treatment strategy. Endovascular techniques include sandwich technique, packing technique, and stent graft placement.⁷⁾ Endovascular treatment involves pseudoaneurysm catheterization and embolization with distal and proximal coiling of the lesion.³⁾ This results in the barring of the aneurysm from circulation, which promotes thrombosis. All nine cases in our study were treated successfully using the endovascular technique. Coiling remains the preferred technique in our region due to its availability and low cost. The sizes of available coils are limited here; hence, in the case of a large pseudoaneurysm, either multiple coils or a coil with glue technique is used. One patient underwent embolization using histoacryl glue due to the unavailability of the appropriate size of coils and a larger size of the neck of the aneurysm. Covered stent grafts are costly and unavailable in an emergency setting; hence, they are not used for embolizing splenic pseudoaneurysms in our setup. One patient developed splenic infarction as a complication of endovascular coiling, which did not require any intervention. Two patients died during the same hospital stay due to multiorgan failure and DIC caused by the initial life-threatening hemorrhage.

Sindh with its 47.9 million population is the third largest province of Pakistan and has 29 districts. However, there are only a few centers with expertise in interventional radiology, all of which are located in the capital of the province. The distance between rural districts and the city is approximately 300–600 km, with a travel time of 6–9 h. Most of these districts do not even have the facilities for a CT angiogram. Hence, in our practice, the most important factor associated with a better outcome is the timely diagnosis and intervention. A typical history of splenic pseudoaneurysm with a middle-aged person exhibiting acute or chronic pancreatitis with or without a pseudocyst presenting with sudden deterioration in clinical condition with abdominal pain, gastrointestinal bleeding, or hypovolemic shock should raise clinical suspicion. Considering the limited resources, ultrasound with color Doppler study can be considered an initial diagnostic modality.²¹⁾ Because the size of the pseudoaneurysm does not reflect the risk of rupture, all patients should be treated for pseudoaneurysms. In our setup, all such patients should be referred to a tertiary care center with available expertise and safe transfer capabilities. Considering the unavailability of an air ambulance, the referral should be performed early and to the closest center before the onset of catastrophic bleeding. Kalva et al.²⁰⁾ observed that the hemodynamic status of the patient is the most significant factor associated with a good outcome whereas the requirement of multiple blood transfusion before angiography was associated with a poor outcome.

Conclusions

Splenic artery pseudoaneurysm is a rare but fatal pathology. Early diagnosis based on clinical suspicion and timely intervention remain the mainstay of treatment for this condition. Our experience and the literature review prove the high risk of pseudoaneurysm rupture; hence, we recommend immediate intervention regardless of the size or location of the pseudoaneurysm with the endovascular-first approach.

Disclosure Statement

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Author Contributions

Study conception: WI, FS, NJ

Data collection: WI, NJ

Analysis: WI

Manuscript preparation: WI, HS, NJ

Critical review and revision: all authors

Final approval of the article: all authors

Accountability for all aspects of the work: all authors

References

- 1) Stanley JC, Fry WJ. Pathogenesis and clinical significance of splenic artery aneurysms. *Surgery* 1974; **76**: 898-909.
- 2) Bedford PD, Lodge B. Aneurysm of the splenic artery. *Gut* 1960; **1**: 312-20.
- 3) Tessier DJ, Stone WM, Fowl RJ, et al. Clinical features and management of splenic artery pseudoaneurysm: case series and cumulative review of literature. *J Vasc Surg* 2003; **38**: 969-74.
- 4) Davis T, Minardi J, Knight J, et al. Ruptured splenic artery aneurysm: rare cause of shock diagnosed with bedside ultrasound. *West J Emerg Med* 2015; **16**: 762-5.
- 5) Agrawal GA, Johnson PT, Fishman EK. Splenic artery aneurysms and pseudoaneurysms: clinical distinctions and CT appearances. *AJR Am J Roentgenol* 2007; **188**: 992-9.
- 6) Huang IH, Zuckerman DA, Matthews JB. Occlusion of a giant splenic artery pseudoaneurysm with percutaneous thrombin-collagen injection. *J Vasc Surg* 2004; **40**: 574-7.
- 7) Xin J, Xiao-Ping L, Wei G, et al. The endovascular management of splenic artery aneurysms and pseudoaneurysms. *Vascular* 2011; **19**: 257-61.
- 8) Loffroy R, Guiu B, Cercueil JP, et al. Transcatheter arterial embolization of splenic artery aneurysms and pseudoaneurysms: short- and long-term results. *Ann Vasc Surg* 2008; **22**: 618-26.
- 9) Gorski U, Agarwal V, Nair V, et al. Endovascular and percutaneous transabdominal embolisation of pseudoaneurysms in pancreatitis: an experience from a tertiary-care referral

- centre. *Clin Radiol* 2021; **76**: 314.e17-23.
- 10) Ddin NU, Berlas FT, Rehman KU, et al. Outcomes of femoral artery pseudoaneurysm in intravenous drug abusers managed at a tertiary care center. *Cureus* 2021; **13**: e13350. Accessed 2021/02//
 - 11) Fatimi SH, Malik AI, Ashfaq A, et al. Primary pseudoaneurysm of the descending aorta. *Indian J Surg* 2013; **75 Suppl 1**: 472-4.
 - 12) Shaikh R, Sohail S, Shaikh PA, et al. Pseudoaneurysm of left proximal common carotid artery following penetrating trauma. *Pak J Med Sci* 2017; **33**: 1291-3.
 - 13) Shahabuddin S, Sami SA. Tuberculous ascending aortic pseudoaneurysm. *Interact Cardiovasc Thorac Surg* 2013; **17**: 742-3.
 - 14) Chia C, Pandya GJ, Kamalesh A, et al. Splenic artery pseudoaneurysm masquerading as a pancreatic cyst—a diagnostic challenge. *Int Surg* 2015; **100**: 1069-71.
 - 15) Ammori BJ, Madan M, Alexander DJ. Haemorrhagic complications of pancreatitis: presentation, diagnosis and management. *Ann R Coll Surg Engl* 1998; **80**: 316-25.
 - 16) Sandblom P. Gastrointestinal hemorrhage through the pancreatic duct. *Ann Surg* 1970; **171**: 61-6.
 - 17) Farsi D, Hafezimoghadam P, Zare MA. Splenic artery pseudoaneurysm: learning from errors. *BMJ Case Rep* 2012; **2012 jun28 1**: brc1020114903. Accessed 2012/06//
 - 18) Guillon R, Garcier JM, Abergel A, et al. Management of splenic artery aneurysms and false aneurysms with endovascular treatment in 12 patients. *Cardiovasc Intervent Radiol* 2003; **26**: 256-60.
 - 19) McDermott VG, Shlansky-Goldberg R, Cope C. Endovascular management of splenic artery aneurysms and pseudoaneurysms. *Cardiovasc Intervent Radiol* 1994; **17**: 179-84.
 - 20) Kalva SP, Yeddula K, Wicky S, et al. Angiographic intervention in patients with a suspected visceral artery pseudoaneurysm complicating pancreatitis and pancreatic surgery. *Arch Surg* 2011; **146**: 647-52.
 - 21) Mišović M, Golubović J, Sekulić I, et al. Possibility of radiological diagnostics of splenic artery pseudoaneurysm—a case report and review of literature. *Acta Medica Medianae* 2019; **177**-83.