Original Article

Splenic Artery Embolisation: An Institutional Case Series

[1]Dr. Vishal Nandkishor Bakare, [2]Dr. Krishna Teja Nerella*

1. Assistant Professor, Department of Interventional Radiology, Dr. D.Y. Patil Medical College, Hospital and Research Centre, Pune, Maharashtra, India
2. Assistant Professor, Department of Radiology, Dr. D.Y. Patil Medical College, Hospital and Research Centre, Pune, Maharashtra, India

*Corresponding Author
Dr. Krishna Teja Nerella, Assistant Professor, Department of Radiology, Dr. D.Y. Patil Medical College, Hospital and Research Centre, Pune, Maharashtra, India
Email: Krishna.teja666@gmail.com
DOI: 10.47750/pnr.2022.13.S10.03

Abstract

Pancreatitis is one of the common causes of acute abdomen, with vascular complications being most dangerous life-threatening ones. They include formation of vessel thrombosis, erosion of vessel wall and formation of pseudo aneurysm due to release of activated pancreatic enzymes. Pseudoaneurysms most commonly affect the splenic artery, gastro-duodenal, pancreatico-duodenal, gastric and hepatic arteries. Rupture of this pseudo-aneurysms can be fatal due to massive bleeding. Hence prompt diagnosis and treatment of these lesions is necessary to prevent further catastrophe.

Keywords: splenic artery, acute pancreatitis, pseudo-aneurysms

Case 1: 45 years male patient was admitted with severe abdominal pain and distention. He had past history of chronic pancreatitis. Serum Lipase (750 IU/L) and Amylase (620 IU/L) levels were elevated in present admission leading to diagnosis of acute pancreatitis. On examination, there was tachycardia (pulse 112/min), hypotension (BP 86/66 mmHg) with abdominal mass and guarding. Hemoglobin was low (5 gm/dl). CT scan revealed hyperdense peri-splenic hematoma [Figure 1a] along with large pseudo-cyst with internal hemorrhage [Figure 1b & 1c]. Patient was taken for emergency Angiography sos embolisation. Selective celiac angiogram revealed no obvious pseudo aneurysm from the splenic artery [Figure 1d]. However, considering the location of pseudocyst and high suspicion of bleeding source from the splenic artery, it was decided to go ahead with mid-splenic artery embolisation with micro-coils [Figure 1e]. Post embolisation, patient was shifted to ICU for care. There was no further drop in Hb and vasopressor supports needed prior to embolisation were also weaned off. Patient was discharged from the hospital on post operative day 7.
Case 2: 38 years male patient, case of acute panceatitis, was admitted with sudden drop in Hb (4.5 gm/dl). On examination, there was tachycardia (Pulse 108/min) and hypotension (BP 90/60 mmHg). CT Angiography did not reveal any obvious pseudoaneurysm from splenic artery [Figure 2a], but there was large pseudocyst in the right side of abdomen [Figure 2b]. Patient was taken for emergency Angiography sos embolisation. Selective splenic artery angiogram revealed small pseudoaneurysm arising from the proximal splenic artery [Figure 2c]. Splenic artery embolisation was done proximal and distal to site of pseudoaneurysm – Sandwich technique [Figure 2d]. Post embolisation the pseudoaneurysm was excluded from circulation suggesting successful treatment. The patient had no further drop in Hb levels and was discharged from the hospital on post-operative day 6.

Case 3: 17 years male patient with recurrent pancreatitis was admitted with severe left hypochondriac pain since 2 days. Serum Lipase (850 IU/L) and Amylase (700 IU/L) levels were elevated diagnosing acute pancreatitis. There are tachycardia (pulse 120/min), hypotension (BP 78/66 mmHg) with severe drop in Hb (4.2 mg/dl). CT Abdomen revealed large splenic and peri-splenic hematoma [Figure 3a & 3b] along with atrophic pancreatic parenchyma and peri-pancreatic fat stranding. Considering the presence of acute pancreatitis, surgical splenectomy was not preferred. Patient was taken for emergency Angiography sos embolisation. Selective celiac angiogram revealed punctuate areas of parenchymal blush in the intra splenic arteries suggestive of splenic contusions [Figure 3c]. Splenic parenchymal embolisation was done using 150–250-micron Poly-vinyl alcohol particles. This was followed by distal and mid splenic artery embolisation using micro-coils [Figure 3d]. Post embolisation, the patient was shifted to ICU, he had no further drop in Hb with gradual weaning off of vasopressor supports. However, on post operative day 4, he developed high grade fever and recurrent pain in left hypochondrium for which CT abdomen was done. It revealed abscess formation at site of splenic and peri-splenic hematoma post embolisation, which was drained using ultrasound guided insertion of pigtail drainage catheter [Figure 3e]. However, later patient underwent surgical splenectomy after resolution of acute pancreatitis. Patient was discharged from hospital after 25 days.

Case 4: 52-year male patient, chronic alcoholic, with history of chronic pancreatitis was referred to hospital with diagnosis of Acute pancreatitis and sudden drop in Hb. He had history of surgical splenectomy 1 year back due to abscess formation. Blood investigations revealed low Hb (4 mg/dl), elevated Serum Lipase (600 IH/L) and Amylase (580 IU/L) levels. CT Angiography revealed large pseudo aneurysm arising from the mid splenic artery [Figure 4a & 4b]. Selective splenic artery angiogram revealed large pseudo aneurysm arising from the mid-splenic artery [Figure 4c]. Splenic artery embolisation was done using microcoils, proximal and distal to the site of pseudoaneurysm – Sandwich technique [Figure 4d]. Post embolisation, patient was shifted to ICU for further care and was discharged from the hospital on post-operative day 8.

DSA Angiography Technique: The angiography and embolisation procedure was done in Cathlab. Patient was keeping nil-by-mouth for 4-6 hours prior to procedure, all necessary blood investigations done. Under ultrasound guidance and local anesthesia, right femoral artery access was taken using 11 cm, 5F vascular sheath (Cordis Medical). Selective celiac artery angiograms were taken using 5 F SIM 1 catheter (Cordis Medical). When needed, selective access was taken in splenic artery using 2.7 F micro-catheter (Progreat, Terumo). For splenic parenchymal embolisation, 150-250 microns Polyvinyl alcohol particles (Cook Medical) were utilized. For splenic artery embolisation , microcoils were utilized (Cook Medical). Post embolisation, the femoral arterial puncture site was closed by manual compression for 20 – 25 minutes, hemostasis confirmed and patient shifted to ICU for observation and further management. 6 – 8 hours supine immobilization was advised to prevent bleeding from the arterial puncture site.

Discussion

The spleen has multiple important functions in the human body like Infection prevention, storage of red blood cells & platelets, hematopoiesis, phagocytosis of senescent RBCs, etc. [1] Therefore preservation of functional splenic parenchyma is priority while managing splenic artery pseudonaeuryms or splenic parenchymal injuries [1,2].

A pseudoaneurysm is leakage of arterial blood from inside the vessel into adjacent tissue and is usually contained by overlying media, adventitia of the artery or surrounding soft tissue structures [3]. In some cases, these pseudoaneurysms may be asymptomatic due to small size and detected incidentally [3]. However, they may present with mass effect on adjacent neuro-vascular structures or life-threatening hemorrhage post rupture [3]. The mortality post rupture of splenic artery pseudo-aneurysm approaches 100% [4,5]. Therefore, all pseudonauerysms, whether symptomatic or not, need treatment.

Various imaging modalities like Duplex Doppler ultrasound (US), helical computed tomography (CT) angiography, magnetic resonance (MR) angiography can diagnose such pseudo-aneurysms [6], however, Conventional Angiography is the gold standard. It can access the hemodynamics of the source vessel on real time basis, identify the collateral supply decide expendability of the donor inflow artery. The pseudoaneurysms which are not seen on

ultrasonography, CT and MR angiography can be seen on Conventional DSA angiography along with concurrent therapeutic intervention [7].

The splenic artery arises from the celiac trunk along with common hepatic and left gastric arteries. The first branch of the splenic artery is dorsal pancreatic artery from the proximal part, the second branch is arteria pancreatica magna from mid portion and third branch being caudal pancreatic artery from distal part of the splenic artery. The splenic artery supplies the spleen, body & tail of pancreas and part of stomach.

As per literature, the treatment options for splenic artery aneurysms include medical treatment, endovascular treatment and surgery depending upon age, aneurysm dimension, origin and the severity of the clinical findings and their complications [8,9,10]. Considering the risk of post-splenectomy sepsis and increased risk of certain infections in later life, physicians have adopted splenic preservation approach, whenever possible [1,2]. Medical management in adult patients with splenic trauma has high failure rates (from 2% to 52%) with need for secondary splenectomy and hence not preferred for now [11,12].

In patients with trauma related splenic injuries with unstable hemodynamics, surgery is preferred, whereas, in patients with stable hemodynamics endovascular management is of choice [13].

Endovascular treatment being minimally invasive, can be performed under local anesthesia and has early post-operative recovery and short hospital stay, with high success and low complication rates. Thus, it is recommended in high-risk patients with multiple co-morbidities like recent major abdominal surgery, intra-peritoneal adhesions, etc [14]. However, the limitations are lack of availability of these high-end facilities at all places with resources for emergency procedures; access site related issues, contrast toxicity and prolonged imaging surveillance [15].

Depending upon the pattern of injury, splenic artery embolisation can be Proximal (PSAE) or Distal (DSAE) [16]. PSAE decreases the systolic arterial pressure and blood flow in the spleen, promoting hemostasis and healing of injured splenic parenchyma and increasing hepatic artery blood flow in post liver transplant splenic artery steal syndrome [16,17]. DSAE is preferred in cases of focal arterial injuries like pseudo-aneurysms [18].

The spectrum of abnormalities that can be seen on angiography range from arterio-venous fistula, pseudoaneurysms, abrupt vessel truncation and rarely seen frank extravasation [19]. Splenic contusion appears as punctuate areas of parenchymal blush in the intra splenic arteries [19]. Splenic artery aneurysms are most common visceral artery aneurysms [19]. Small aneurysms have diameter <2cm [19], whereas giant aneurysms have diameter >5 cm [20]. Their incidence is higher in patients with portal hypertension [19]. The other contributory factors include pregnancy, fibromuscular dysplasia, infection, pancreatitis and congenital anomaly [19].

Percutaneous endovascular interventional procedures such as transcatheter embolisation, placement of covered stent grafts or percutaneous injection of coils / thrombin / glue are commonly used to manage splenic artery aneurysms [19]. When possible, the site of occlusion should be kept precise so as to preserve the collateral flow to spleen via the gastric, omental and pancreatic vessels [16].

The commonly utilized embolization technique for pseudoaneurysms is “Sandwich Technique” in which the embolization is done distally and proximally to the site of pseudoaneurysm to prevent forward and backflow from any collateral circulation [3,21].

Coils are permanent embolic agents commonly used which are available in different sizes (diameter and length). For adequate embolisation the diameter of coils used in transcatheter embolization should be 20-30% larger than the diameter of the artery [22]. The possible complications post coil embolisation are non-target embolization due to coil migration, pseudoaneurysm rupture, infection [22,23]. Coils depend upon body’s coagulation system to achieve complete embolisation [22,23].

N-butyl cyanoacrylate (glue) is liquid permanent embolic agent. It polymerises rapidly to form cast when in contact with blood [22,23]. Therefore, it has to be diluted with Ethiodized oil to slow the rate of polymerization and achieve optimal embolization [22]. Ethiodized oil also provides radio-opacity to the solution. However, this technique requires adequate expertise as potential complications like non-target embolization and catheter trapping are frequent [23].

Gelatin sponge is temporary, low-cost embolic agent which is made into gelfoam slurry after mixing with iodinated contrast agent [23]. It is mainly used in emergency situations [23]. The main complication is high risk of infection [23].

Amplatzer vascular plug is three-dimensional nitinol mesh device that are used to occlude the pseudonauerysms from medium sized arteries [23]. They are oversized by 30-50% with respect to the vessel diameter [22]. The advantages are high success rates and controlled deployment [23]. In cases when the aneurysmal neck is wide and parent artery diameter optimally large, stent graft placement to exclude the aneurysm from circulation has been effective to preserve the splenic arterial blood flow [24,25].

When the transcatheter embolisation is not possible or failed, percutaneous 22G Chiba needle placement into the aneurysmal sac followed by coil / thrombin injection has been successfully performed [26,27]. Thrombin injection caused activation of the coagulation cascade which converts fibrinogen to fibrin with formation of clot. The complications of thrombin injection are non-target embolization, allergic reaction, infection and recurrence from collateral supply [26,27].

The complications of endovascular interventions can be divided into puncture site, procedure site and post embolization complications [28,29]. Bleeding, hematoma, pseudonaeurysm, arterial dissection and thrombosis, arterio-venous fistula formation are puncture site related complications [28,29]. Procedure site complications include rupture of pseudoaneurysm, arterial dissection, non-target embolisation, coil migration and infection [30,31]. Post embolization syndrome seen as pain, fever and vomiting is usually transient [29]. Suboptimal embolization may result in recurrence of pseudoaneurysm [32].

The indications for surgery are patients with unstable hemodynamics, pseudoaneurysm causing significant mass effect, infected pseudo-aneurysms and cases in which endovascular management has failed [3]. Open laparotomy with aneurysm ligation with / without splenectomy was Gold standard of management, however, recent development in laparoscopic surgery has made lesser morbidity and faster recovery possible [33]. The Surgical mortality approaches 16% for pseudoaneurysms in head of pancreas and 50% for lesions in the tail [34].

Conclusion

Considering the high mortality post rupture, al visceral artery pseudo-aneurysms need immediate management. In recent era, minimally invasive interventional radiology techniques are preferred over surgery. They have high success rates with lower morbidity and complications.

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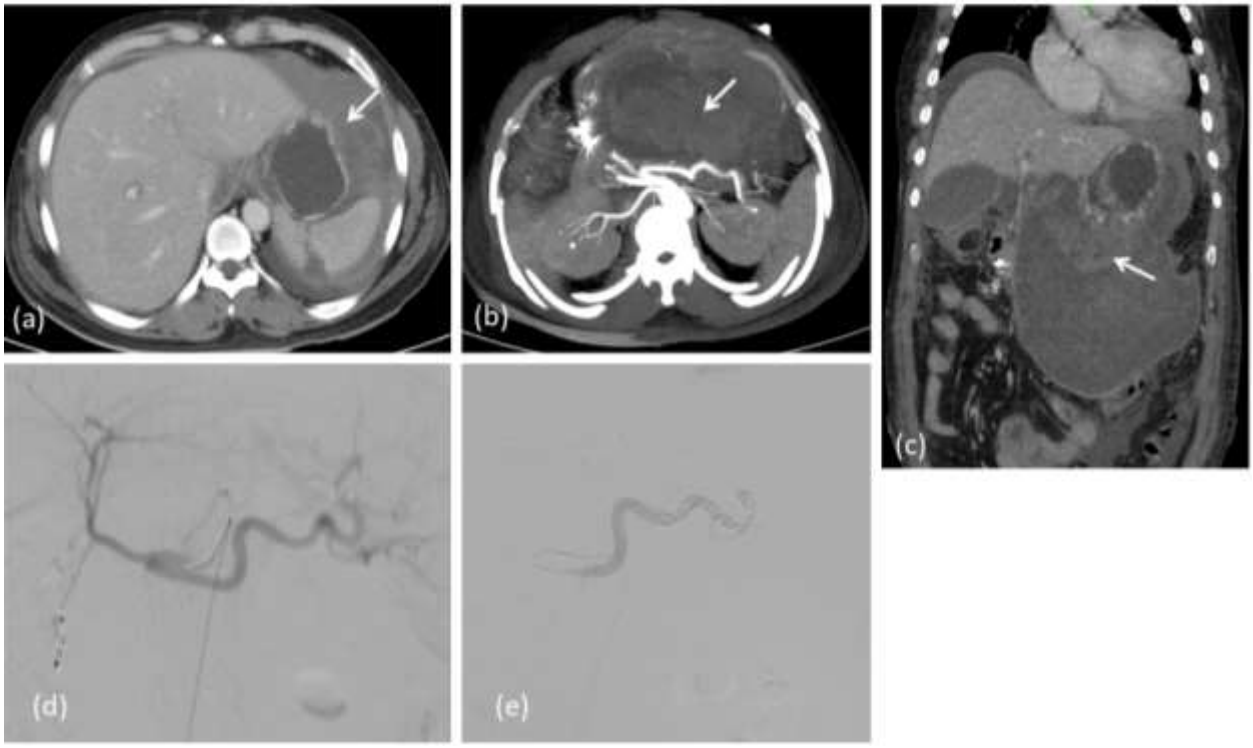

Figure (1a) Axial post contrast CT scan image shows peri-splenic hematoma with non-enhancing focal area in spleen likely infarct.
Figure (1b) Axial CT Angiography image showing large pseudocyst with internal hemorrhage
Figure (1c) Sagittal CT scan image showing large pseudocyst with internal hemorrhage
Figure (1d) DSA image showing selective celiac artery angiogram
Figure (1e) Post embolisation selective celiac artery angiogram DSA image showing micro-coils within the splenic artery with non-contrast opacification of its lumen.

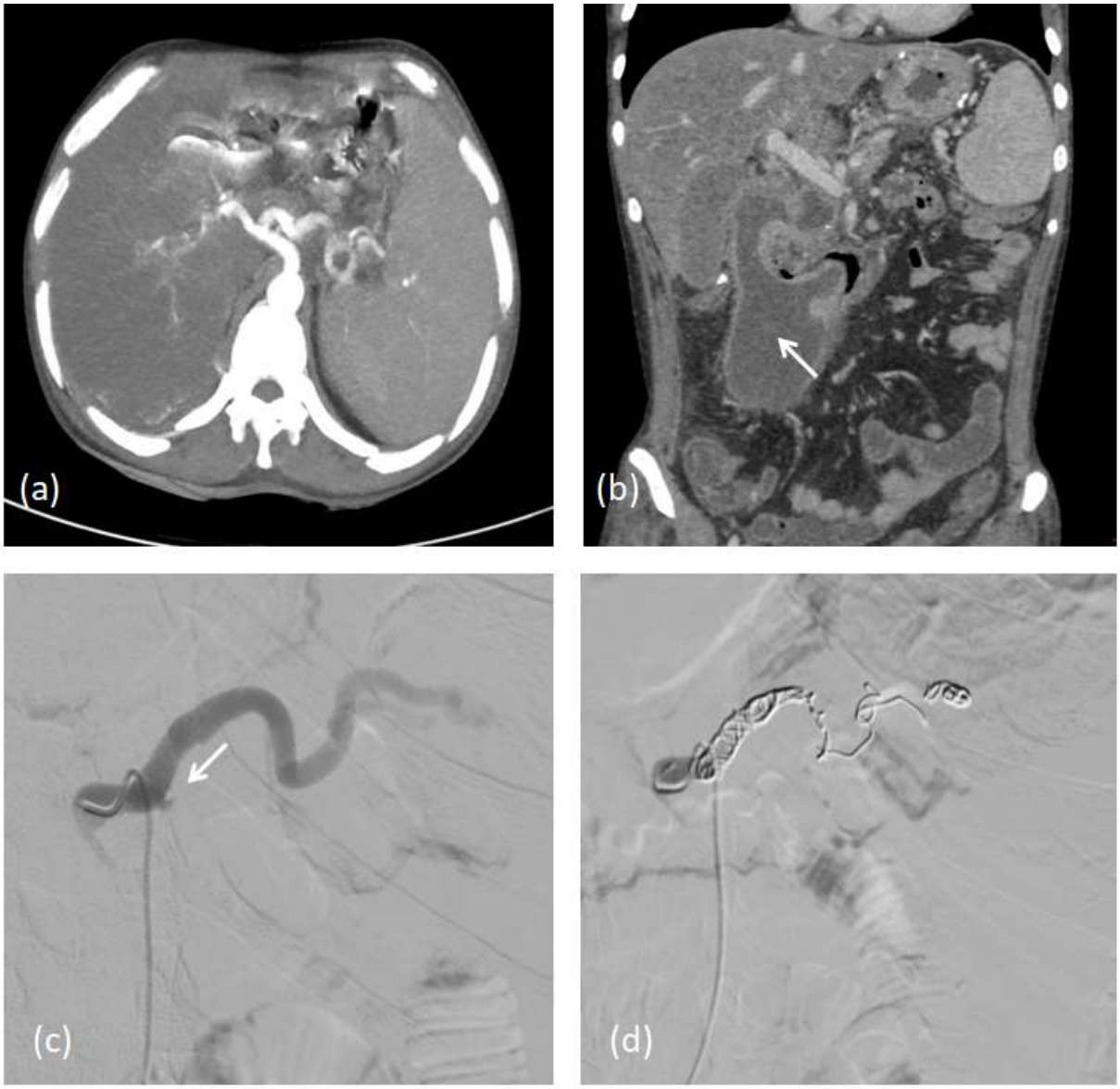

Figure (2a) Axial CT Angiography image showing celiac trunk, common hepatic artery and splenic artery.
Figure (2b) Sagittal CT scan image showing pseudo cyst on right side of abdomen.
Figure (2c) DSA Angiography image of selective celiac artery angiogram showing pseudo aneurysm arising from proximal splenic artery.
Figure (2d) Post embolisation selective splenic artery angiogram DSA image showing micro-coils within the splenic artery with non-contrast opacification of its lumen.

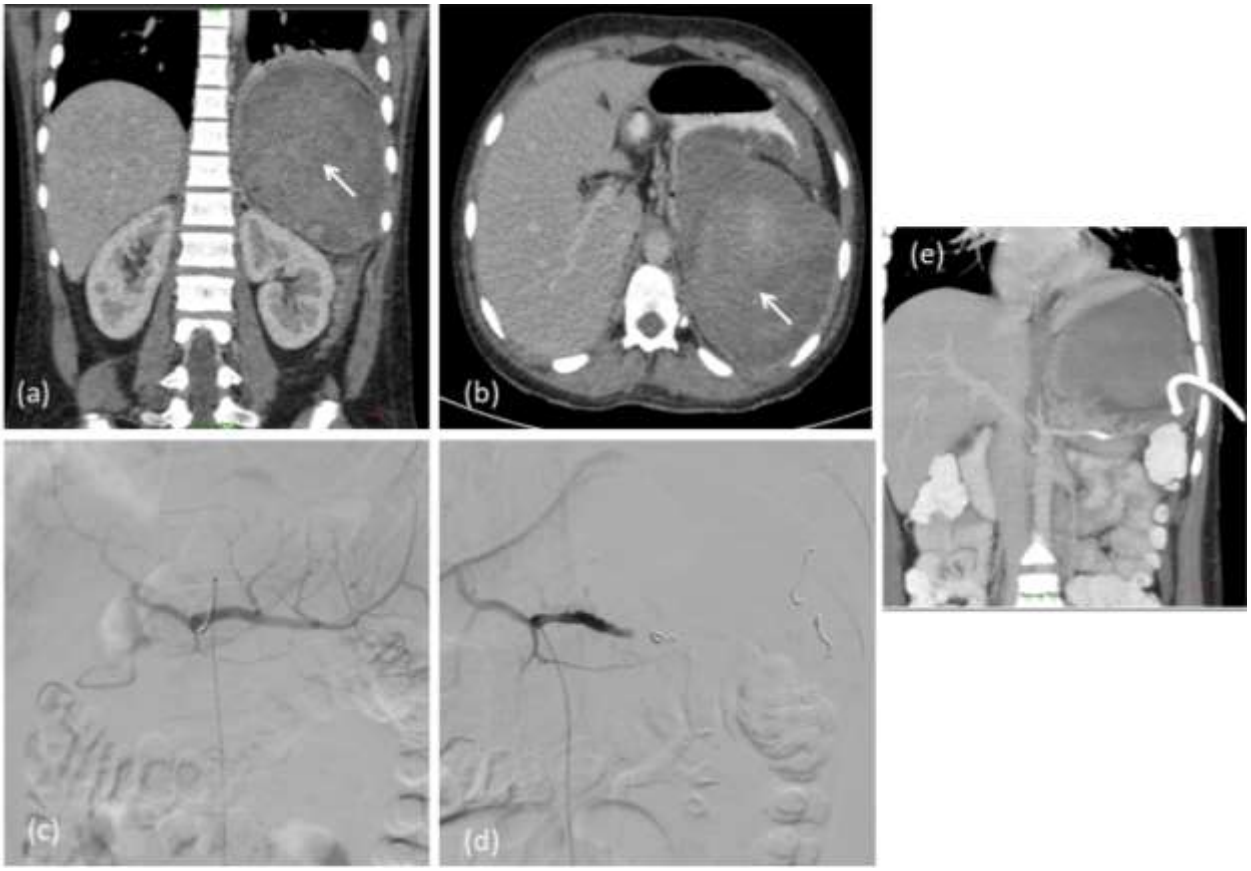

Figure (3a) Sagittal post contrast CT scan image showing large splenic and peri-splenic hematoma.
Figure (3b) Axial post contrast CT scan image showing large splenic and peri-splenic hematoma
Figure (3c) DSA Angiography image of selective celiac artery angiogram showing punctuate areas of parenchymal blush in the intra splenic arteries suggestive of splenic contusions.
Figure (3d) Post embolisation selective celiac artery angiogram DSA image showing micro-coils within the proximal & distal splenic artery with non-contrast opacification of its lumen
Figure (3e) Post contrast Axial CT scan image showing large non-enhancing abscess formation within the splenic hematoma post-embolisation. It was treated with ultrasound guided insertion of 14 F pigtail drainage catheter.

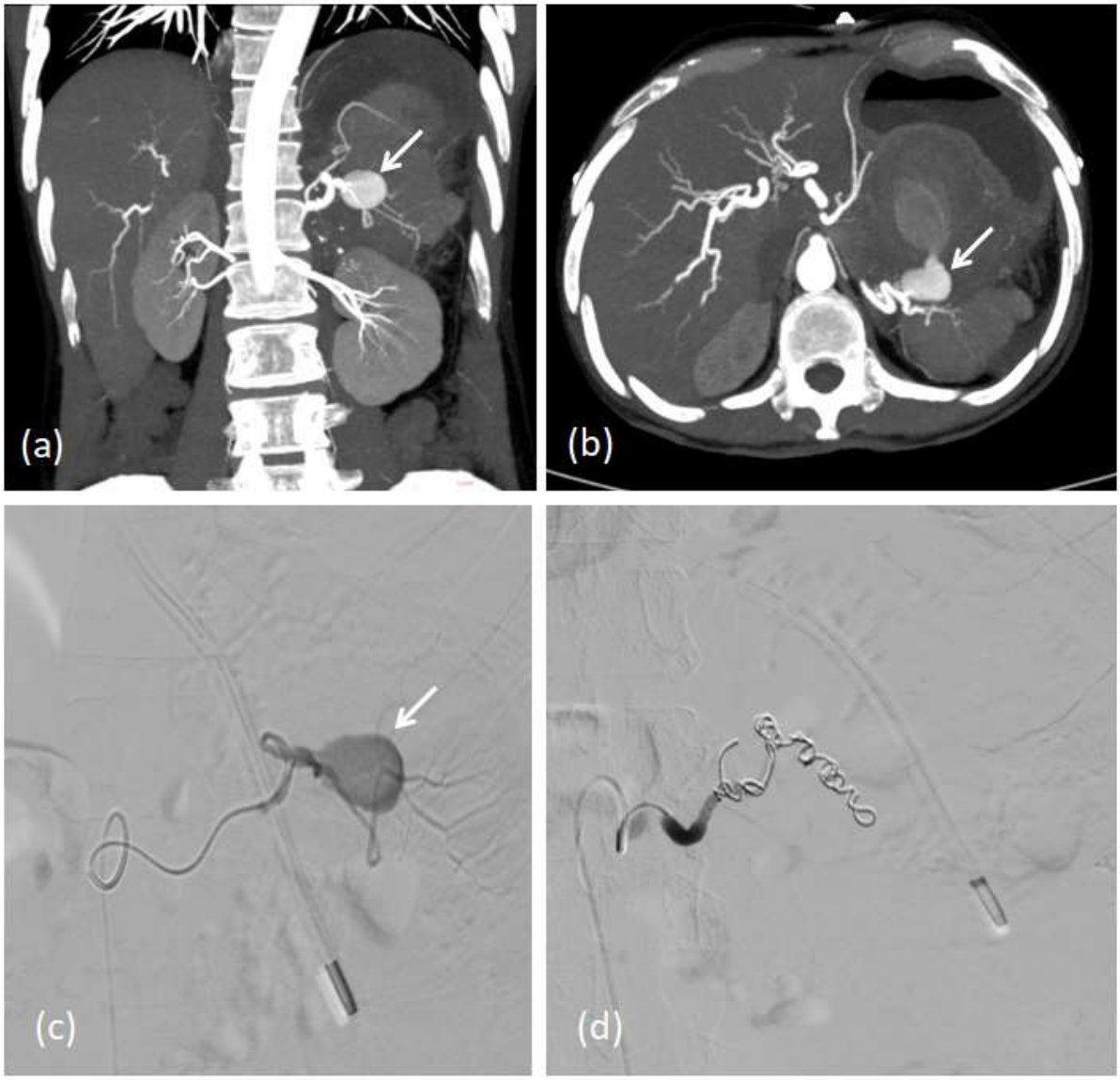

Figure (4a) Sagittal CT Angiography image showing large pseudo aneurysm arising from the mid splenic artery.
Figure (4b) Axial CT Angiography image showing large pseudo aneurysm arising from the mid splenic artery.
Figure (4c) Selective splenic artery DSA Angiography image showing large pseudo aneurysm arising from the mid splenic artery.
Figure (4d) Post embolisation Selective splenic artery DSA image showing micro-coils within the splenic artery, proximal and distal to the site of pseudo aneurysm (Sandwich technique), with non-contrast opacification of its lumen.