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## Case report

# Partial splenic embolization treats recurrent left pleural effusions in a patient with portal venous system thrombosis <sup>☆</sup>

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## ABSTRACT

A 56-year-old female with thrombocytopenia complicated by portal venous system thrombosis presented with recurrent left pleural effusions after failed recanalization via mechanical thrombectomy and stenting at an outside center. With no other cause, splenic vein thrombosis and left-sided portal hypertension was suggested as a possible etiology. Partial splenic embolization was performed with immediate decrease in effusions and resolution by 8 weeks. Portal and splenic venous system thrombosis may cause recurrent pleural effusions from left-sided portal hypertension and fluid leakage across diaphragmatic defects. Upper pole partial splenic embolization may treat recurrent left pleural effusions and offer an alternative to splenectomy.

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## Brief report

A case of partial splenic embolization treating recurrent left pleural effusions in a patient with portal venous system thrombosis is described. The Institutional Review Board (IRB) at the participating institution does not require approval for this type of report.

A 56-year-old female with essential thrombocytopenia developed total intra- and extrahepatic portal vein (PV), splenic

vein (SV), and superior mesenteric vein (SMV) thrombosis. She had failed mechanical thrombectomy at an outside center and presented as an outpatient to our clinic with complaints of recurrent left pleural effusions requiring thoracentesis 1-2 times a week. Given that she required anticoagulation (AC) for thrombocytopenia, it was difficult to schedule her thoracentesis around her AC schedule. The patient had no history of lung or liver disease, portal hypertension, or imaging findings to support any disease process other than thrombocytopenia and total PV and SV thrombosis.

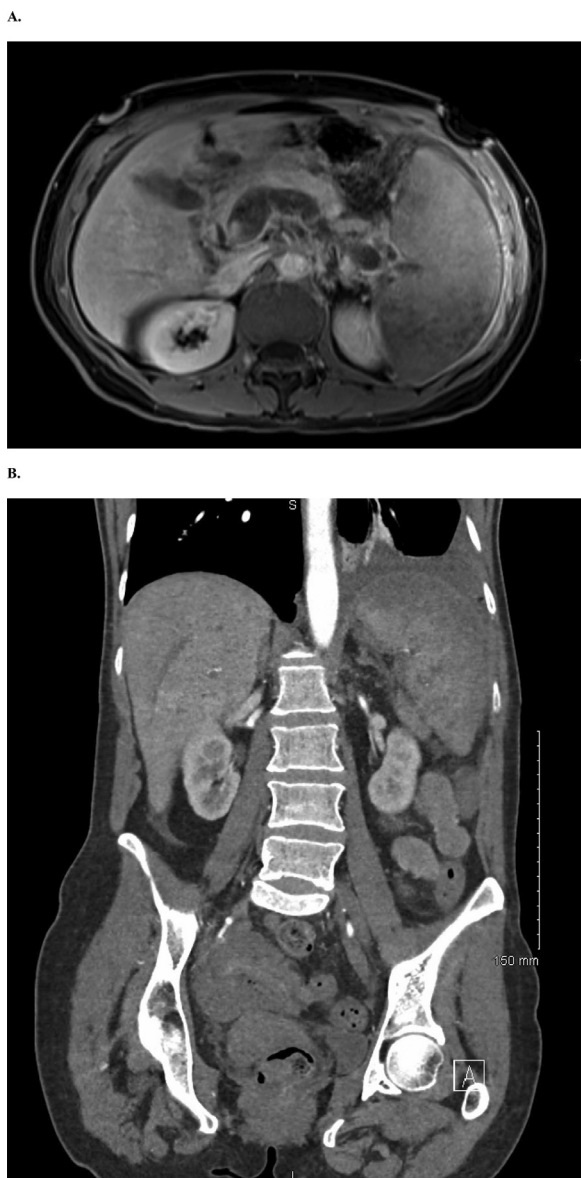
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**Fig. 1 – Pre-embolization CT following attempted PV recanalization and thrombolysis with SMV and PV stenting at an outside institution. (A) SV thrombosis and PV thrombosis and (B) splenomegaly and left pleural effusion are demonstrated.**

She had initially presented to our institution to pursue either tunneled pleural drain placement or pleurodesis. Computed tomography (CT) showed a moderate left pleural effusion, splenomegaly, and complete thrombosis of the PV, SV, and SMV (Fig. 1). There were no signs of cirrhosis, liver lesions, or diaphragmatic defects.

It was hypothesized that the patient's effusion may be from left-sided portal hypertension (LpHTN) and fluid leakage through small defects in the left hemi-diaphragm, similar to the mechanism of hepatic hydrothorax and right pleural effusions. Partial splenic embolization was proposed with the aim of preventing effusion by attenuating underlying LpHTN and necrosing the upper pole of the spleen where the proposed



**Fig. 2 – Post-operative subtracted splenic angiogram showing post-embolization changes in the superior spleen and continued perfusion in the inferior spleen.**

leakage was occurring. Leading up to partial splenic embolization, the patient's thoracentesis requirements had increased to almost every other day. This was especially cumbersome and risky to the patient since she had to discontinue her AC the night before each session. Additionally, she was very anxious undergoing thoracentesis as she had experienced a pneumothorax at an outside hospital after one of the procedures.

After discussion of risks and possible benefits in ambulatory clinic the patient signed informed consent. Briefly, the procedure was performed utilizing right common femoral artery access with a 5F catheter and 2.3F microcatheter. The entire upper pole of the spleen was embolized utilizing 1.5 vials of 300-500um Embospheres (MERIT, South Jordan UT) until there was significantly decreased flow (Fig. 2). The patient required 48 hours admission for left upper quadrant pain control and antiemetics. On post-procedure day (PPD) 1, an ultrasound (US) fluid assessment was performed revealing a moderate left pleural effusion. She had a left thoracentesis removing 1.5L of amber colored pleural fluid, which she tolerated well. She was subsequently discharged on PPD 2 and sent home with analgesics and antiemetics as needed.

The patient was seen for follow up six weeks and 30 weeks post-procedure. She denied ascites or shortness of breath but reported three thoracenteses: once two weeks post-procedure with 1.1 liters removed, once five weeks post-procedure with 1.1 liters removed, and once eight weeks post-procedure with 0.7 liters removed. From weeks 12-30 post procedure she had no thoracentesis. She further reported US pleural fluid assessments in post-procedure months 3 and 4 where there was no pleural fluid visible. A timeline of the patient's thoracenteses is summarized in Table 1.

The patient received no other treatment for her pleural effusions or PV thrombosis, and had no change in medications. The immediate and dramatic decrease in, and soon thereafter absence of, pleural effusions following partial splenic embolization strongly suggests this was the cause of the resolution of her signs and symptoms.

Current theories for the link between splenic pathology and left pleural effusion include 1) regional inflamma-

**Table 1 – Summary of thoracenteses before and after partial splenic embolization.**

	Timing relative to partial splenic embolization	Thoracentesis frequency	Volume of fluid removed (L)
Pre-embolization	Months before procedure	Weekly	3
	Weeks leading up to procedure	Every other day	Variable
Partial splenic embolization			
Post-embolization	Post-operative day 1	One occurrence	1.5
	2 weeks post-operatively		1.1
	5 weeks post-operatively		1.1
	8 weeks post-operatively		0.7
	3 months post-operatively		0
	4 months post-operatively		0

tion causing increased subphrenic permeability or 2) regional swelling or mass effect causing compressive obstruction of posterior lymphatics that drain the chest [1,2]. Neither of these mechanisms can be ruled out in this case, but they are less likely given the absence of symptomatic or radiologic evidence of abdominal inflammation or obstructed lymphatics.

This case confirms earlier reports that portal and splenic venous system thrombosis can cause pleural effusions from LpHTN and fluid leakage via small diaphragmatic defects. It suggests that splenic embolization could be used as an acceptable treatment for recurrent left effusions due to LpHTN. Reports of recurrent left pleural effusions associated with splenic injury have been well documented [1,3,4], most of which only cleared after splenectomy [1,3]. Partial splenic embolization has been used to treat hypersplenism, variceal bleeding, and hepatic encephalopathy in patients with portal hypertension [5–9]. However, scarce literature describes splenic embolization to treat recurrent left pleural effusions. One study used partial splenic embolization as an adjunct to splenectomy for recurrent left pleural effusions, however, the embolization was only performed to reduce intraoperative blood loss prior to a complex case [10]. This report supports the role of splenic embolization as a novel treatment consideration for recurrent left pleural effusion and an alternative rather than an adjunct to splenectomy.

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### Patient consent

The patient consented to have her health information published.

### REFERENCES

- [1] Warren MS, Gibbons RB. Left-sided pleural effusion secondary to splenic vein thrombosis: a previously unrecognized relationship. *Chest* 1991;100(2):574–5.
- [2] Leung F, Williams A, Oill P. Pleural effusion associated with urinary tract obstruction: support for a hypothesis. *Thorax* 1981;36(8):632.
- [3] Koehler PR, Jones R. Association of left-sided pleural effusions and splenic hematomas. *AJR Am J Roentgenol* 1980;135(4):851–3.
- [4] Suliman I, Guirguis J, Chyshkevych I, Dabage NF. Splenic injury with subsequent pleural effusion: an underreported complication of colonoscopy. *Case reports in gastroenterology* 2019;13(1):6–11.
- [5] Abdella HM, Abd-El-Moez AT, El-Maaty MEA, Helmy AZ. Role of partial splenic arterial embolization for hypersplenism in patients with liver cirrhosis and thrombocytopenia. *IJG* 2010;29(2):59–61.
- [6] Alwmark A, Bengmark S, Gullstrand P, Joelsson B, Lunderquist A, Owman T. Evaluation of splenic embolization in patients with portal hypertension and hypersplenism. *Ann Surg* 1982;196(5):518.
- [7] Romano M, Gjojelli A, Capuano G, Pomponi D, Salvatore M. Partial splenic embolization in patients with idiopathic portal hypertension. *Eur J Radiol* 2004;49(3):268–73.
- [8] Sangro B, Bilbao I, Herrero I, et al. Partial splenic embolization for the treatment of hypersplenism in cirrhosis. *Hepatology* 1993;18(2):309–14.
- [9] Kocoris KG, Singh H, Soares G. Partial splenic embolization in the treatment of patients with portal hypertension: a review of the english language literature. *J Vasc Interv Radiol* 2007;18(4):463–81.
- [10] Patrono D, Benvenga R, Moro F, Rossato D, Romagnoli R, Salizzoni M. Left-sided portal hypertension: Successful management by laparoscopic splenectomy following splenic artery embolization. *J Vasc Interv Radiol* 2014;5(10):652–5.