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## Case report

# Unusual case of left-sided portal hypertension induced variceal bleeding after pancreaticoduodenectomy treated with transsplenic embolization ☆☆☆★★

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## ABSTRACT

With the advances in surgical technique and the accumulation of experiences, pancreatic cancer with portal-superior mesenteric vein (PV-SMV) invasion is no longer considered as an absolute contraindication for surgical resection. After resection of the PV-SMV confluence, congestion of the splenic vein (SV) may develop, resulting in splenomegaly and variceal formation, also known as left-sided portal hypertension (LPH). Along with improved post-operative prognosis, LPH induced varices are given enough time to develop and eventually bleed, which can be lethal. We present a 59-year-old woman who underwent pancreaticoduodenectomy (PD) for pancreatic cancer with a concomitant PV-SMV resection. Massive upper gastrointestinal bleeding and hypovolemic shock occurred 15 months after the surgery. Various exams, including endoscopy, dynamic computed tomography (CT) imaging, celiac, and superior mesenteric artery (SMA) angiography, were performed. However, the exact location of the bleeding could not be identified. LPH-induced varices bleeding was suspected and diagnosed by venography. The varices were embolized with n-BCA and lipiodol mixture by trans-splenic venous approach with complete cessation of bleeding. It is important to identify potential life-threatening LPH-induced varices bleeding, especially if certain clinical histories or classic imaging findings are presented. As for treatment, interventional radiology methods could be considered as the first choice.

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## Introduction

Pancreatic cancer has a poor prognosis. The best chance of survival is by surgical resection. With the advances in surgical technique and the accumulation of surgeon experiences, pancreatic cancer with portal-superior mesenteric vein (PV-SMV) invasion is no longer considered as an absolute contraindication to resection [1,2]. Concomitant PV-SMV resection is recommended during pancreaticoduodenectomy (PD) to get a tumor-free margin in the absence of metastatic disease [1,2]. After division of the splenic vein (SV), venous flow from the SV results in varices formation and splenomegaly, which are defined as left-sided portal hypertension (LPH), although rare, may cause some critical problems [3,4,5].

## Case presentation

A 59-year-old woman underwent PD with a concomitant PV-SMV resection for pancreatic cancer. The patient was discharged without complications. Fifteen months after her surgery, the patient suffered from melena, hypovolemic shock. Massive upper gastrointestinal (UGI) bleeding was suspected.

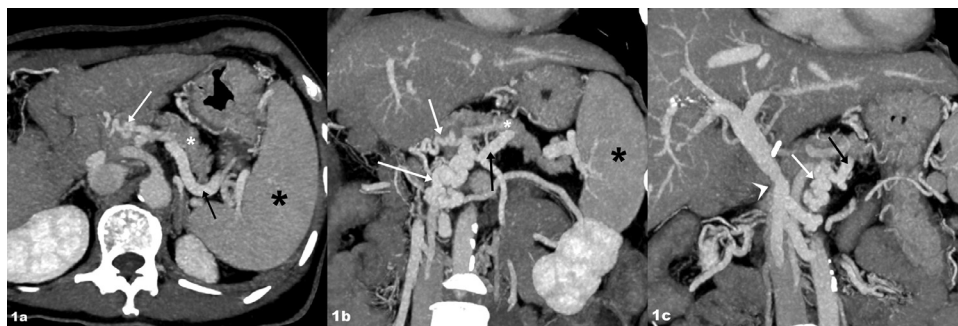
Emergent UGI endoscopic examination revealed blood clots at the proximal jejunal limb. Dynamic computed tomography (CT) imaging reflected splenomegaly and engorged varices surrounding the pancreaticojejunostomy (PJ) that communicated with the SV (Figs. 1A, 1B and 1C). Emergent celiac and superior mesenteric artery (SMA) angiogram were performed to exclude arterial bleeding but did not identify a source of hemorrhage. Therefore, LPH-induced variceal bleeding was thought to be the main cause.

Arterial portography was performed and demonstrated multiple orifices and small caliber veins at portal vein end, which may increase the difficulty to access the whole varices by trans-portal approach (Fig. 2). As a result, we arranged retrograde venography via a trans-splenic approach by puncturing the SV by Neff Percutaneous Access system (Cook Medical). A



**Fig. 2 – Splenic venous return drains from varices formations (white arrow) and IMV (black arrow) are demonstrated by arterial portography. Notice that there are multiple orifices and small caliber veins at portal vein end (white arrowhead), which increase the difficulty to access the whole varices by trans-portal approach.**

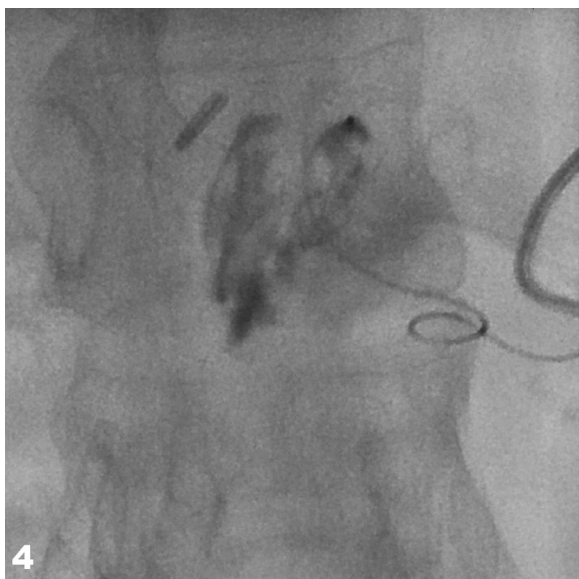
five Fr. Short sheath (Radifocus Introducer II, Terumo), a five Fr. Torcon NB Advantage Catheter (KMP, Cook Medical) and a 1.98 Fr. ASAHI masters PARKWAY SOFT microcatheter (Asahi Intecc) were used to gain access to the varices (Figs. 3 and 4). The varices around the PJ disappeared after obliteration using a 1:1 ratio of N-butyl cyanoacrylate (NBCA) to lipiodol with preserved main splenovenous return toward inferior mesenteric vein (Figs. 5A and 5B). The splenic access was embolized by Tornado® Embolization Coil (Cook Medical) and Microfibrillar Collagen Hemostat (AVITENE, Bard Medical). The symptoms resolved after embolization. Follow-up CT at 6 months after



**Fig. 1 – (A&B): Axial and coronal view of maximal intensity projection (MIP) post-contrast CT are performed 15 months after the pancreaticoduodenectomy with a concomitant PV-SMV resection. The images show the splenic vein (black arrow) drains into varices formation at pancreaticojejunostomy with mucosa involvement (white arrow; pancreas: white star). Splenomegaly is also observed (black star). (C): Oblique view of maximal intensity projection (MIP) post-contrast CT reveals the varices formations (white arrow) and the reconstructed PV-SMV with mild narrowing at anastomosis. (white arrowhead). A portion of the splenic vein is also identified (black arrow).**



**Fig. 3 – Retrograde venography is performed via trans-splenic approach by direct puncturing the splenic vein. DSA imaging reveals varices formation, which is compatible with CT findings.**



**Fig. 4 – Contrast extravasation is seen when gaining access to the varices with microcatheter.**

this procedure revealed no varices around the PJ. No recurrent gastrointestinal (GI) bleeding is identified since then.

## Discussion

Pancreatic cancer with PV-SMV invasion was no longer recognized as unresectable thanks to advances in surgical technique and the accumulation of surgeon experiences. Accom-



**Fig. 5 – (A & B): Embolization is performed with 1:1 of N-butyl cyanoacrylate (NBCA) to lipiodol (5A, black arrow). Post-embolization imaging shows total obliteration of varices around the pancreaticojejunostomy (5B, black arrow), with preserved splenovenous return via inferior mesenteric vein (5B, white arrow).**

panying concomitant PV-SMV resection with PD can provide a tumor-free margin [1,2]. According to recent studies, the operative mortality rate after PD has declined below 5%. However, the morbidity remains high with some major complications including pancreatic fistula, intra-abdominal abscess, and post-PD hemorrhage. Post-PD hemorrhage is a less frequent but more severe complication with 2.5%-20.2% incidence and 11.0%-56.2% related mortality [6,7]. According to the International Study Group of Pancreatic Surgery (ISGPS) definition of the post-pancreatectomy hemorrhage, the patient with post-PD hemorrhage can be divided into early and late groups and should be treated individually according to the pathogenesis [8]. Early post-PD hemorrhage occurs within 24 hours after the end of the operation and is most often a result of technical failure of hemostasis or underlying coagulopathy. Delayed post-PD hemorrhage occurs more than 24 hours after the end of the operation, and is typically from complications such as infection, pancreatic fistula, anastomotic site ulceration and pseudoaneurysm formation [8]. Therefore, it is important to identify the source of bleeding and treat individually based on the etiologies.

Left-sided portal hypertension, also known as sinistral, segmental, regional or splenoportal hypertension, is an uncommon form of portal hypertension and usually occurs from the splenic vein occlusion, usually from various pancreatic pathologies such as chronic pancreatitis, pancreatic pseudocysts, and pancreatic neoplasms. Typical imaging finding includes not only the cause of the splenic vein occlusion but also splenomegaly and varices formations. The varices formation can be found in esophagus, gastric and even in colon. However, due to anatomic variations, it may not always result in varices formations [3]. Ascites formation is also rare unless they have associated cirrhosis or acute dilutional hypoalbuminemia after fluid resuscitation for bleeding [3]. In patient with PD, especially with resection of PV-SMV confluence, congested venous flow of SV may developed, results in splenomegaly and varices formation, which fit the definition of left-sided portal hypertension. In our case, the varices formations developed at pancreaticojejunostomy. Although most patients with LPH are asymptomatic and experience no complication. With improved postoperative prognosis and overall survival, LPH in-

duced varices are given enough time to develop and eventually bleed. Some variceal bleeding induced by LPH can be massive and lethal if not treated [4,5].

Several types of procedures can be considered to treat LPH-related variceal bleeding from PJ, such as total pancreatectomy, splenectomy, partial splenic artery embolization, and obliteration of the varices via a trans-venous approach. Surgical interventions such as splenectomy do not gain wide acceptance because of the high risk of complication and is considered as a more invasive procedure [9]. Partial splenic artery embolization is reasonably safe and is used to treat LPH induced varices bleeding according to some case reports. However, some studies show that splenic artery embolization can lead to several complications including splenic abscess, sepsis, and splenic rupture [9].

There are several types of trans-venous approach to access portovenous system, such as trans-hepatic approach, trans-jugular intrahepatic portosystemic shunt (TIPS) or trans-splenic approach. Trans-hepatic approach is considered safe and usually the first choice, while trans-splenic approach is considered as a high-risk intervention because spleen is a high vascularity structure. However, in one retrospective study by Mustafa M. Haddad et al, there are no significant difference in overall complication rates and all-bleeding complications between trans-splenic approach and trans-hepatic approach (12.5% vs 9.7% ( $P=0.679$ ) and 12.5% vs 8.1% ( $P=0.440$ )), and the successful rates are similar (91.6% and 96.8% ( $P=0.238$ )) [10]. Therefore, trans-splenic approach can be considered as an alternative approach especially when patient present contraindication or difficulty to other types of access.

In our case, we decide to perform trans-splenic approach by puncturing the SV based on anatomic considerations. Furthermore, it can preserve the splenic arterial flow. As a result, Interventional radiology methods could be the first choice for intestinal bleeding at the PJ because of LPH after PD and PV-SMV resection.

## Conclusion

In summary, left-sided portal hypertension, although rare, may cause potential life-threatening varices bleeding after PD with PV-SMV resection. It can be one of the differential diagnosis in patient with GI bleeding if certain clinical histories or classic imaging findings are presented. As for treatment options, interventional radiology methods including partial

splenic artery embolization and transvenous approach should be considered as the first choice.

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## REFERENCES

- [1] Ramacciato G, Mercantini P, Petrucciani N, et al. Does portal-superior mesenteric vein invasion still indicate irresectability for pancreatic carcinoma? *Ann Surg Oncol* 2009;16:817–25.
- [2] Han SS, Park SJ, Kim SH, et al. Clinical significance of portal-superior mesenteric vein resection in pancreatoduodenectomy for pancreatic head cancer. *Pancreas*; 2012;41:102–6.
- [3] Seyfettin K, Sahin C, Osman Y, et al. Left-Sided Portal Hypertension. *Dig Dis Sci*; 2007;52:1141–9.
- [4] Ono Y, Matsueda K, Koga R, et al. Sinistral portal hypertension after pancreaticoduodenectomy with splenic vein ligation. *Br J Surg*; 2015;102:219–28.
- [5] Kushiya H, Noji T, Abo D, et al. Treatment of bleeding from a portion of pancreatojejunostomy after pancreatoduodenectomy with division of the splenic vein: Two case reports. *Surg Case Rep*; 2019;5:128. doi:10.1186/s40792-019-0687-5.
- [6] Feng J, Chen YL, Dong JH, et al. Post-pancreaticoduodenectomy hemorrhage: risk factors, managements and outcomes. *Hepatobiliary Pancreat Dis Int* 2014;13(5):513–22.
- [7] Wei HK, Wang SE, Shyr YM, et al. Risk factors for post-pancreaticoduodenectomy bleeding and finding an innovative approach to treatment. *Dig Surg*; 2009;26(4):297–305.
- [8] Wente MN, Veit JA, Bassi C, et al. Post pancreatectomy hemorrhage (PPH): an international study group of pancreatic surgery (ISGPS) definition. *Surgery* 2007;142(1):20–5.
- [9] David C. Madoff, Alban Denys, et al (2005) Splenic arterial interventions: anatomy, indications, technical considerations, and potential complications. *Radiographics*; 25(Suppl 1): S191–S211
- [10] Haddad MM, Fleming CJ, Thompson SM, et al. Comparison of bleeding complications between transsplenic versus transhepatic access of the portal venous system. *J Vasc Interv Radiol*; 2018;29(10):1383–91.