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Case Report

Successful treatment of gastric bleeding caused by left phrenic artery pseudoaneurysm post-surgery with endovascular embolization: A case report ☆

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ABSTRACT

Pseudoaneurysms are rare but potentially life-threatening complications that may occur after surgical procedures. This report presents the case of a 28-year-old woman who developed a pseudoaneurysm in the Left Inferior Phrenic Artery (LIPA) following a Laparoscopic Sleeve Gastrectomy (LSG). The complication manifested as severe gastrointestinal bleeding. Upper GI Endoscopy and multislice CT scan, repeated twice, failed to localize the bleeding source to treat it.

Successful endovascular embolization using a Glue/Lipidol mixture was achieved despite difficulties in localizing the pseudoaneurysm, resulting in immediate symptomatic relief and avoiding surgical intervention. This case shows the importance of prompt identification and management of LIPA pseudoaneurysms following LSG, highlighting the importance of early diagnosis to prevent further hemodynamic deterioration and other adverse outcomes.

Introduction

Pseudoaneurysms are vascular lesions that result from damage to blood vessel walls, which can occur as a complication of surgical procedures like bariatric surgeries [1]. One rare complication of gastrectomy procedures is pseudoaneurysms arising from gastric arterial feeders [2]. We report a case of a young woman who developed a Left Inferior Phrenic Artery Pseudoaneurysm (LIPA) after undergoing a Laparoscopic Sleeve Gastrectomy (LSG). She presented with severe gastrointestinal bleeding, which was challenging to locate by CT scan and endoscopy. One of the possible management options in such cases is endovascular embolization, a minimally invasive technique that utilizes fluoroscopy to identify and block blood flow to the pseudoaneurysm.

☆ Competing Interests: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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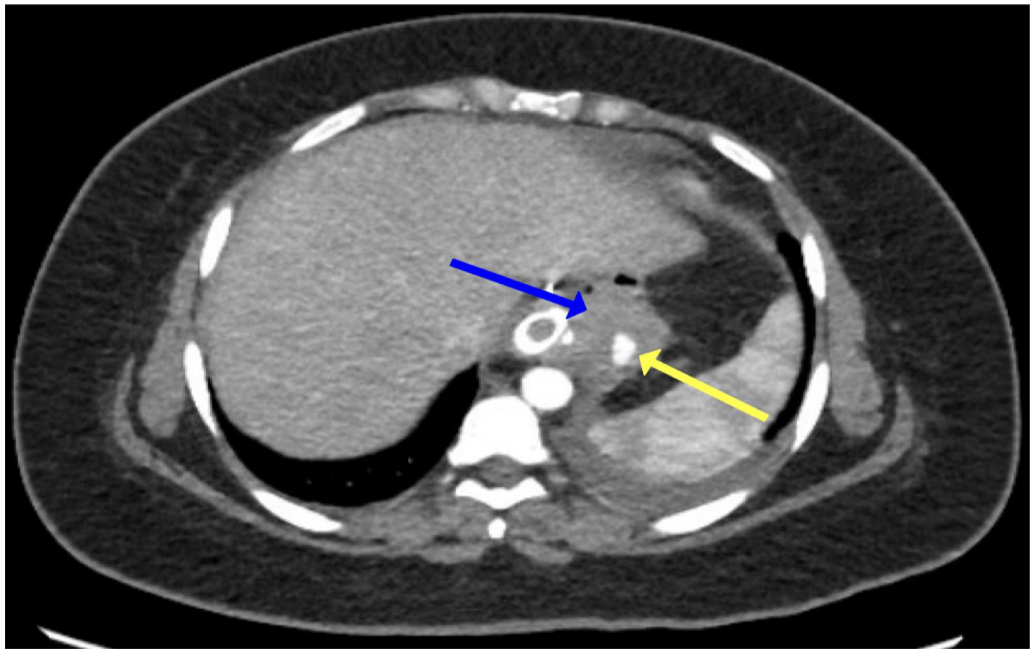

Fig. 1 – An axial image of contrast-enhanced abdomen CT with arterial phase at the diaphragm level shows a focal contrast blush in the arterial phase (yellow arrow) measuring 1.1 cm (AP) x 1.7 cm (W) surrounded by a hematoma (blue arrow) measuring 4 cm (AP) x 4.7 cm (W), indicating a pseudoaneurysm.

Case report

A 28-year-old woman visited the general surgery clinic with a 5-day history of blood-stained vomiting and black stool (melena). These symptoms began approximately five days after she was discharged from the same hospital following an uneventful Laparoscopic Sleeve Gastrectomy (LSG). She was admitted by the surgical team for further investigations and management.

Initial investigations included a Complete Blood Count (CBC), which revealed low Hemoglobin (6 g/dL) and elevated white blood count (12.5 $\times$ 10^9/L). An endoscopy of the upper gastrointestinal tract revealed a gastric leak and bleeding from the greater curvature of the stomach. The exact site of leak was not identified and no management was initiated. Still, the source of the bleeding vessel could not be identified for proper control of bleeding. A CT scan of the abdomen showed focal inflammation and a nonenhancing ill-defined collection in the perigastric area, suggesting an infected hematoma. A CT angiogram was performed to locate the source of bleeding, revealing arterial extravasation near the surgical area lateral to the stomach and a suspected leak around the gastroesophageal (GE) junction. Still, the bleeding vessel could not be identified.

Subsequently, the patient was admitted to the Intensive Care Unit (ICU) for close monitoring. She was given a trial of conservative management with a Proton Pump Inhibitor infusion, Total of 14 units of Packed Red Blood Cells, 4 units of Fresh Frozen Plasma, and intravenous antibiotics. She did not require any form of hemodynamic or respiratory support during her ICU stay and was subsequently transferred back to the ward.

Despite the previous management, she continued to experience hematemesis and melena. The case was referred to interventional radiology (IR), who performed a mesenteric angiogram that failed to localize the bleeding vessels. A possible cause for this failure is that the bleeding vessel was expected to be one of the gastric arterial feeders. The possibility of phrenic arteries as a source of bleeding was not expected. Finally, A decision was made to perform empirical embolization of the left gastric artery as a suspected source of bleeding using micro-coils. However, within hours after embolization, the patient had recurrent episodes of hematemesis and melena. The decision was then made to transfer the patient to another center specializing in managing post-gastric sleeve complications.

Upon arrival at our center, the patient was found to be febrile (38.3°C), tachycardic (115 bpm), with a blood pressure of 137/62 mmHg, a respiratory rate of 20 breaths per minute, and an oxygen saturation of 97% on nasal cannula oxygen. She appeared unwell, pale, and fatigued: On examination, her abdomen was soft and lax with normal bowel sounds, with no signs of peritonitis such as guarding or abdominal pain. Slight tenderness in the epigastric area was noted. CBC showed low Hemoglobin and slight leukocytosis. (WBC 12.3 $\times$ 10^9/L, HCT 30%, Hgb 7.2 g/dL) and low potassium level (2.8 mEq/L).

An upper gastrointestinal endoscopy was performed, which revealed a clear site of a leak at the gastroesophageal (GE) junction. The leak site was managed by clipping and inserting a gastroesophageal stent (Niti-S Esophageal Stent, TaeWoong Medical, USA). The site of bleeding was not identified.

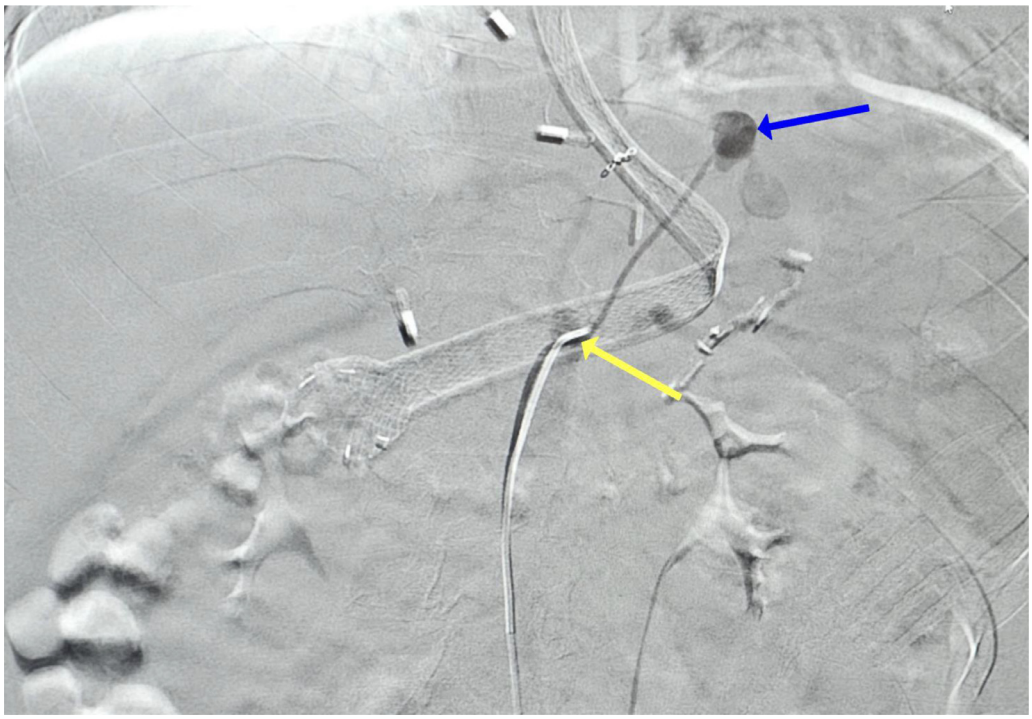

Fig. 2 – Angiogram with a 5 Fr catheter (yellow arrow) near the ostium of the celiac trunk, showing a pseudoaneurysm arising from the Left Inferior Phrenic Artery (LIPA)(blue arrow).

A triphasic CT scan of the abdomen and pelvis with IV contrast followed by oral contrast was performed. This revealed a focal contrast blush in the arterial phase, measuring around 1.1 (AP) x 1.7 cm (W), surrounded by a hematoma measuring around 4 (AP) x 4.7 cm (W) (Fig. 1). The suspected bleeding vessel could not be identified. No contrast leak was detected after oral contrast. The case was referred to IR for consultation and possible embolization.

The patient was transferred to our IR unit and consented for the procedure. Ultrasound-guided access to the left Common Femoral Artery was established. A 5 Fr sheath (Cordis, USA, California) Cobra C1 (Merit Medical, USA, Utah) was used to cannulate the Celiac, Superior Mesenteric, and Left Gastric arteries. The patient was uncooperative and continuously vomiting during the procedure, making it challenging to cannulate vessels and obtain proper angiograms. No extravasation of contrast was detected on angiograms. Luckily, a final angiogram near the ostium of the celiac artery clearly showed the source of bleeding: a pseudoaneurysm arising from the Left Inferior Phrenic Artery (LIPA), with extravasation of contrast into the stomach. A microcatheter system (2.8 Fr High Flow Catheter, Boston Scientific, USA, Massachusetts) was used to cannulate the vessel and confirm the site of the bleeding pseudoaneurysm (Figs. 2 and 3). Embolization was performed using a Glue/Lipiodol mix in a 1:3 ratio (n-Butyl Cyanoacrylate Liquid, Glubran 2, GEM, Italy)(Lipiodol (Ethiodized Oil) Injection, Guerbet, France) until the pseudoaneurysm and its feeding vessel were completely embolized. A glue cast was seen overlying the bleeding-feeding branch. Digital subtraction angiogram obtained after embolization showed no residual bleeding or other feeders (Celiac and SMA branches) (Fig. 4). The sheath was removed, and hemostasis was achieved through manual compression.

The patient's condition significantly improved after the procedure. Her vomiting and melena gradually improved. Her abdominal pain improved over the next few days. A gastrografin study revealed free passage of oral contrast through the GE stent to the jejunal loops. Oral intake was subsequently resumed, starting with clear fluids. The patient improved over her hospital stay with no further episodes of hematemesis, reduced amount and frequency of melena, occasional vomiting of non-bloody gastric contents, and no abdominal pain. The patient's lab workout showed marked improvement and stable readings (WBC 9.5×10^9/L, Hgb 8.9 g/dL, HCT 26.2%). Potassium level was within normal (4.19 mmol/L). She was discharged from our hospital after a six-day stay, with follow-up appointments scheduled in both general surgery and dietary clinics. No further CT scan was done after embolization to limit unnecessary radiation and contrast doses.

Discussion

The gastric blood supply is mainly derived from the left gastric artery arising directly from the celiac trunk; the right gastric and gastroepiploic arteries mainly supply the lesser curvature and distal curvature, respectively, while the short gastric and left gastroepiploic arteries supply the greater curvature [3]. The right inferior phrenic artery (RIPA) and the left inferior phrenic artery (LIPA) originated from a common trunk in 11.53% of cadavers and from the celiac trunk in 7.69%. Fur-

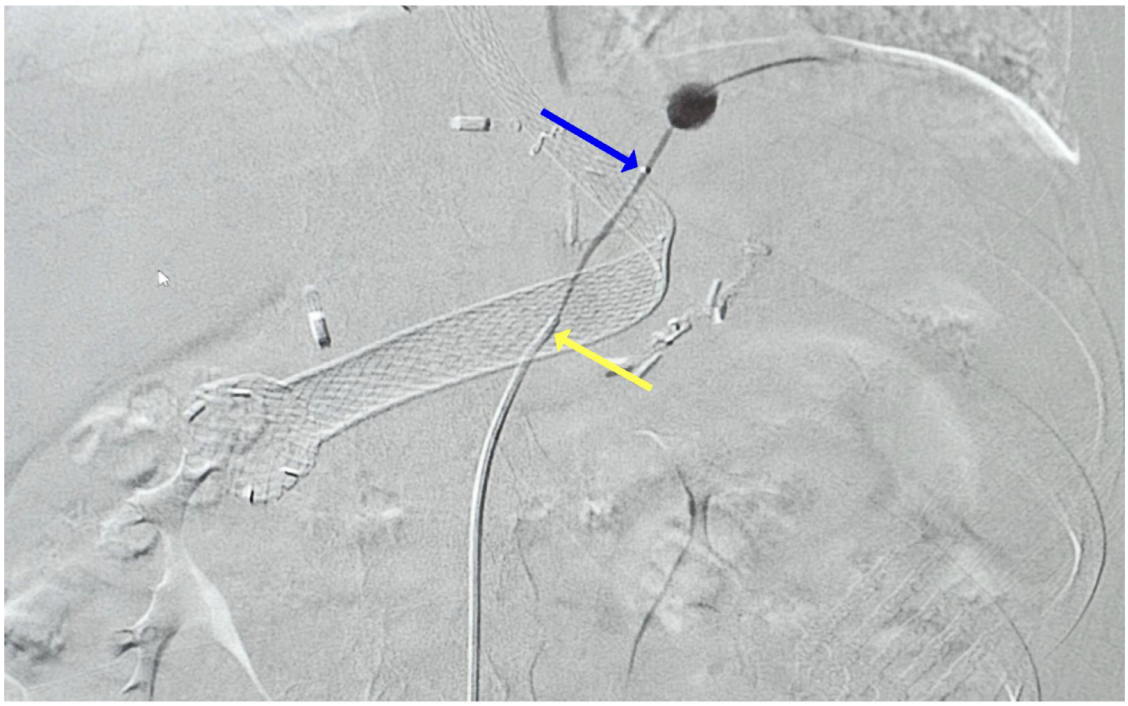

Fig. 3 – Angiogram showing the 5 Fr catheter (Yellow arrow) with the 2.8 Fr microcatheter system (blue arrow) in the LIPA prior to embolization.

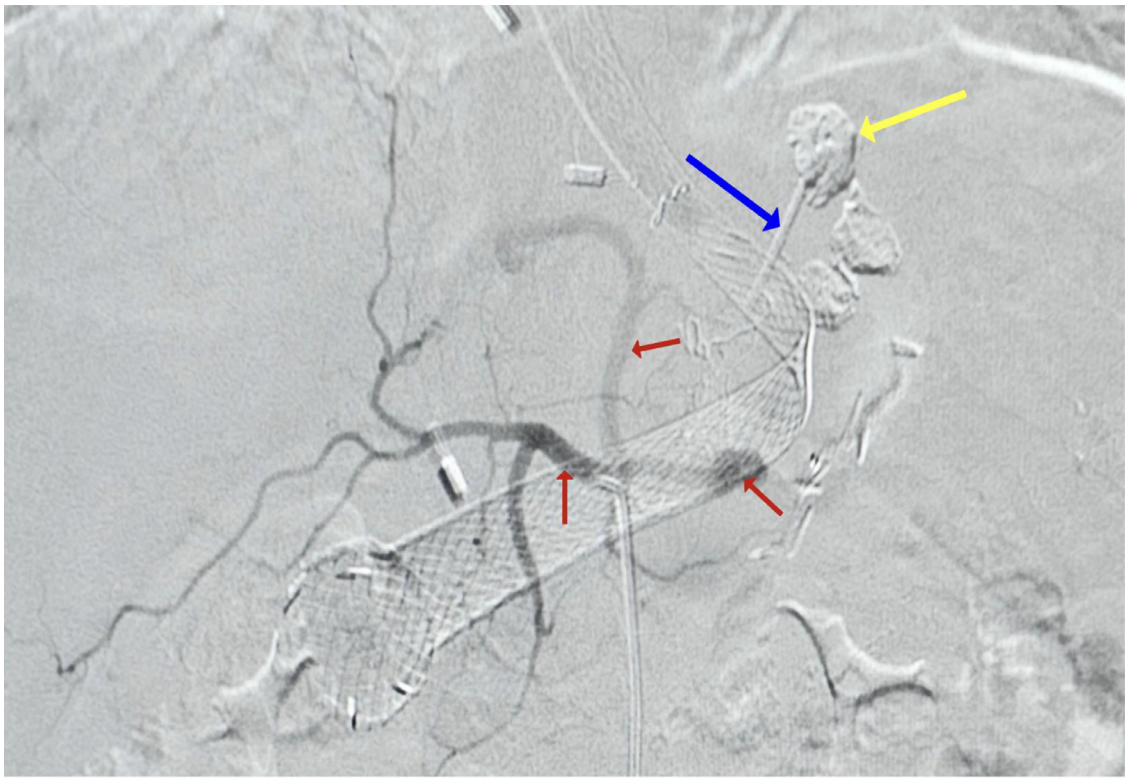

Fig. 4 – A digital subtraction angiogram obtained after embolization of the pseudoaneurysm using Glue/Lipidol 1:3 mixture with glue cast seen in the pseudoaneurysm (yellow arrow) and LIPA (blue arrow). Complete exclusion of the left inferior phrenic artery and the pseudoaneurysm. No residual bleeding or other feeders (Celiac and SMA branches, red arrows).

Table 1 – Similar LIPA pseudoaneurysm cases in the literature.

Author	Title	Diagnosis	Cause	Management of Pseudoaneurysm
Namikawa T. et al, [15]	Transcatheter Arterial Embolization of Ruptured Inferior Phrenic Artery Pseudoaneurysm Following Completion Gastrectomy	LIPA pseudoaneurysm	Roux-en-Y	Embolization; n-Butyl Cyanoacrylate (Glue)
Arora A. et al, [16]	Pseudoaneurysm of the inferior phrenic artery presenting as an upper gastrointestinal bleed by directly rupturing into the stomach in a patient with chronic pancreatitis	LIPA pseudoaneurysm	Chronic Pancreatitis	Embolization; Polyvinyl Alcohol particles
Lee J. et al, [12]	Massive hemoperitoneum due to ruptured inferior phrenic artery pseudoaneurysm after blunt trauma	LIPA pseudoaneurysm	Trauma	Laparotomy; proximal arterial ligation
Aoki M. et al, [13]	Massive hemothorax due to inferior phrenic artery injury after blunt trauma	LIPA pseudoaneurysm	Trauma	Embolization; 1:3 Glue/Lipidol mix

thermore, the LIPA as a lone vessel originated from the abdominal aorta in 34.61% of cadavers, and from the celiac trunk in 23.07% [4]. In our case, the origin of the LIPA appears to be from the celiac trunk. In laparoscopic sleeve gastrectomy, the left gastric artery would mainly supply the nonresected portion of the stomach, with gastric leaks occurring in less than 2% of cases [5].

Sleeve Gastrectomy or "partial gastrectomy" is a bariatric procedure indicated for patients diagnosed with morbid obesity [6]. The most common complication after LSG is gastroesophageal reflux (23%) [7]. Cases of bleeding in the early post operative period occur along the staple line of the gastrectomy in 2.4% of cases [8]. A previous case series showed that 75% of hematemesis post-LSG were caused by pseudoaneurysms, with 2 of the cases arising from the left gastric artery and 1 arising from the splenic artery [9].

In true arterial aneurysms, all three arterial wall layers are intact. This differs from pseudoaneurysms, which are essentially ruptured aneurysms contained by the adventitia or perivascular tissue, thus making them significantly higher risk for true uncontained rupture [10]. Pseudoaneurysms are usually diagnosed using endoscopy and CT angiography as an initial investigation, with the final diagnosis and definite treatment being established through conventional angiography. They are predominantly treated using endovascular embolization instead of open repair, reportedly due to fewer complications and better outcomes [11].

LIPA pseudoaneurysms are rare, with only a few cases reported in the literature (Table 1). It is worth mentioning that trauma was the direct cause of pseudoaneurysm rupture in 2 of the reported cases, leading to severe hemodynamic instability [12,13]. One of those cases was managed through laparotomy, localizing the pseudoaneurysm and treating it by proximal arterial ligation. Unfortunately, the patient died the next day due to adult respiratory distress [12]. A similar case has also been reported, where a RIPA pseudoaneurysm post-LSG was managed with endovascular embolization using microcoils [14].

Pseudoaneurysms, although rare, could lead to life-threatening complications and should be considered in cases of uneventful bariatric surgery for early detection and management.

In conclusion, this case highlights the necessity of identifying LIPA pseudoaneurysms after LSG. Although rare early diagnosis and treatment are critical, including endovascular catheterization for both diagnosis and treatment. Endovascular embolization is invaluable in locating difficult bleeding sources.

Patient consent

We declare that full permission to use and publish the patient's information was received, including all medical records, lab results, and radiographic imaging, in accordance with hospital policy, and that their full anonymity would be maintained as much as possible, and that informed consent for publication of their case was obtained from the patient.

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