Extensive Thrombus and Brain Microabscesses After Sleeve Gastrectomy

Grace Faith Chao[1*], Sameer Hirji[2], Scott Alan Shikora[2]

1. Department of Surgery, Yale-New Haven Hospital, New Haven, USA

2. Department of Surgery, Brigham and Women's Hospital, Boston, USA

* **Correspondence:** Grace Faith Chao, MD, Department of Surgery, Yale School of Medicine, 330 Cedar Street, FMB 107, P.O. Box 208062, New Haven, CT 06519, USA
(*grace.f.chao@yale.edu*)

Radiology Case. 2018 Mar; 12(3):10-17 :: DOI: 10.3941/jrcr.v12i3.3227

ABSTRACT

Sleeve gastrectomy is a relatively newer bariatric surgical procedure and has become the most common of all bariatric surgeries performed. Complication rates reported with sleeve gastrectomies are relatively low and are generally due to staple line leaks, hemorrhage, or sleeve stricture. Portal vein thrombosis is an uncommon but potentially dangerous complication. We present a case of a 21-year-old woman who developed thrombosis of the portal, splenic, and right common iliac veins that then resulted in multifocal brain abscesses from presumed Fusobacterium septic emboli following an uncomplicated laparoscopic sleeve gastrectomy.

CASE REPORT

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A 21-year-old woman with no significant past medical nor surgical history underwent an uneventful sleeve gastrectomy for a body mass index (BMI) of 40 kg/m^2. Her postoperative course was unremarkable except for an early resumption of her oral contraceptive pills (OCPs). At her 2-week follow-up visit, she was noted to have some dysphagia to liquids and constipation.

An upper gastrointestinal series with barium (Figure 1) was obtained which did not demonstrate any leaks or anastomotic abnormalities. The patient was then presumed to be doing better. However, one month following surgery, she presented to the emergency department (ED) with chills, but the infectious workup was negative. She was discharged but then re-presented to the ED with a 2-week history of fevers, left flank pain, and significant laboratory abnormalities, including a white blood cell count to 21.72 K/uL. An abdominal ultrasound demonstrated significant clot burden involving the portal and splenic vein (Figure 2). Computed tomography scan of the abdomen and pelvis revealed an additional superior mesenteric vein thrombosis and splenic infarction with possible abscesses (Figure 3). She was immediately started on a heparin drip and admitted to the hospital. While in-hospital, she developed new-onset double vision and shortness of breath. Her examination was significant for ataxia, flat affect, and weakness of the right side of the face and limbs. A magnetic resonance imaging scan of her brain demonstrated multiple ring enhancing lesions concerning for either septic emboli or microabscesses (Figure 4). Chest X-ray (Figure 5) also showed pleural effusion which required bedside thoracentesis. From an infectious standpoint, her workup was negative with no growth from the cultures of her blood, cerebrospinal fluid, pleural exudate, and urine. She also had negative studies for Human Immunodeficiency Virus, Rapid Plasma Reagin, Cryptococcus, Bartonella, Toxoplasmosis, and neurocystercercosis. Her hypercoagulability workup, however, was significant for low protein C, low antithrombin III, and a positive lupus anticoagulant.

The patient was placed on antibiotics and anticoagulation with heparin for 25 days with eventual

resolution of her pulmonary and neurologic symptoms. She was bridged to warfarin therapy and discharged to a rehabilitation facility. Since discharge, the patient has been doing well and has remained symptom-free at her 6 month and 1 year follow-up. Warfarin therapy was also discontinued 3-months post-discharge after normalization of her D-dimer levels. The patient was most recently seen in bariatric surgery clinic 15 months post-operatively. She was noted to be doing quite well, with a reduction in BMI from 43.34 kg/m^2 to 30.15 kg/m2, representing a 69% excess weight loss. She has also remained neurologically intact.

DISCUSSION

Etiology & Demographics:

Morbid obesity is a rapidly increasing health issue worldwide and is associated with significant social, economic, and health consequences. For instance, a BMI > 30 kg/m^2 has been associated with a 50-100% increased risk of premature death compared to individuals with normal BMI. [1] According to one study, the per capital health care spending in the United States for an obese individual surpasses that of a normal weight individual by $1,429 per year, an amount that is 41.5% greater. [2] In recent years, bariatric or weight loss surgery has emerged as a reliable and preferred weight loss treatment strategy for treatment of obesity and its associated co-morbidities. According to the American Society for Metabolic and Bariatric Surgery Society, about 196,000 bariatric surgery cases were performed in 2015 alone. Sleeve gastrectomy, a relatively newer procedure, has surpassed the gastric bypass operation in terms of popularity, and now accounts for more than half of weight-reduction surgeries. [3] The operative procedure is typically done laparoscopically (Figure 4). Briefly, the gastroepiploic and short gastric vessels are dissected off of the greater curvature of the stomach. A bougie catheter or endoscope is advanced into the antrum of the stomach. The greater curvature of the stomach is resected from the rest of the stomach with a stapler, using the bougie or endoscope as a guide. The greater curvature of the stomach is then removed, leaving behind a stomach that is about 25% of its former size, and shaped like a banana or tube.

Several studies have also demonstrated that sleeve gastrectomy results in meaningful efficacy yet fewer complications than the previously preferred gastric bypass procedures, especially in terms of safety, feasibility, morbidity and mortality. [3] Generally, complication rates reported with sleeve gastrectomies are relatively low and are usually due to staple line leaks, hemorrhage, or sleeve stricture. The most feared of these is a staple line leak which occurs in 1.06% of cases and can lead to prolonged hospitalization, sepsis, multi-organ failure, and even death. [4] The rate of infection is 0.4% [3], and that of venous thromboembolism is 0.215%. [3] The overall risks associated with these procedures could potentially be significant, and should be carefully weighed on an individual basis.

Clinical & Imaging Findings:

Brain abscesses in the setting of hypercoagulability and sepsis following bariatric surgery are extremely rare and have not been previously reported. Our patient presented with extensive micro-abscesses, most likely from portal venous thrombosis following laparoscopic sleeve gastrectomy. Fortunately, these micro-abscesses were responsive to antibiotic treatment with eventual resolution of her neurologic and pulmonary symptoms. The most common causes of brain abscesses are anaerobes, *Streptococci*, *Enterobacteriaceae*, *Staphylococcus aureus*, and fungi. [5] Approximately 30-60% of brain abscesses are polymicrobial. Among the anaerobes, *Fusobacterium* is one of the most commonly isolated species [6] and a common cause of septic emboli. A case series of patients with *Fusobacterium nucleatum*-positive cultures showed that the etiology was likely due to oral or gastrointestinal flora. [7]

Notably, our patient did not experience neurologic sequelae after resolution of the microabscesses. Studies, however, show that anywhere from 20-79% of patients may experience neurologic sequelae depending on how quickly the diagnosis is made and antimicrobials are administered. [8] While the pathophysiology of this particular case remains unclear, an iatrogenic *Fusobacterium* sepsis could have occurred either in the setting of thrombosis or gut translocation of bacteria causing multiple infarcts and diffuse hypoperfusion, leading to superinfection of existing thrombi.

Patients who develop brain abscesses may experience neurologic disturbances depending on the location of the abscess. On imaging, ring-enhancing lesions are the classic finding on head MRI or CT. Additionally, superior mesenteric vein and splenic vein thromboses may be visualized on CT as hypodense lesions in the vasculature with associated hypodense areas in the associated organs due to infarction from lack of perfusion.

Treatment & Prognosis:

Brain abscesses are treated with systemic antibiotics targeting the likely culprits of the infection, in this case, typical gut flora were of interest. Additionally, patients with extensive thrombi should be treated with anticoagulation and likely placed on lifetime anticoagulation if the thrombi burden is in an atypical location or secondary to an atypical event.

Differential Diagnoses:

Immunosuppression:

Surgery is known to cause nutritional and immunologic changes in patients. A previous case report presented a patient who underwent a laparoscopic gastric bypass and subsequently developed disseminated abdominal tuberculosis. [9] While the etiology was unclear, one hypothesis given was that the patient's surgery and rapid weight loss created changes in nutritional status and alterations in the patient's immune system, allowing for tuberculosis infection or reactivation. A similar mechanism could have contributed to our patient's development of sepsis and septic emboli with seeding to the brain. In another study examining patients who underwent any type of bariatric surgery and who also developed a complication, the incidence of shock/sepsis was found to be 6.33% and 12.38%, respectively, in the two cohorts of 1,469 patients experiencing pre-discharge complications and 3,619 patients experiencing post-discharge complications [10].

Vitamin Deficiency:

When neurologic sequelae occur in bariatric patients following surgery, they are often due to vitamin deficiency rather than infectious etiologies. For instance, in a study of 60 patients after laparoscopic sleeve gastrectomy, 9% developed vitamin B12 deficiency within 1 year despite strict vitamin supplementation. [11] Copper deficiency has also been shown to have similar neurologic effects. [12] However, our patient's visual disturbances, gait problems and myalgias appeared less likely to have been caused by her inability to take her vitamins given the short time period to development of symptoms following surgery.

Surgically Induced Hypercoagulability:

While deep vein thrombosis (DVT) is a known complication following bariatric surgery, the incidence of hypercoagulability is not well known. A study of two university hospitals in Israel recorded 16 cases (0.55%) of portal-splenic-mesenteric venous system thrombosis in 2,886 patients who underwent laparoscopic sleeve gastrectomy. [13] Of note, in the same study, DVT was not observed in any of the 1500 laparoscopic Roux-en-Y gastric bypass, gastric banding, and biliopancreatic diversion patients. Given these findings, the incidence of DVT may be related to the operative technique of constructing a gastric sleeve. Interestingly, the overall thrombosis rate was significantly lower in laparoscopic sleeve gastrectomy patients who received a course of enoxaparin 1-4 weeks after discharge (P=0.01).

Oral Contraceptive Induced Hypercoagulability:

This patient's use of OCPs could have contributed to the development of her hypercoagulable state. A few studies have shown an association of estrogen containing OCPs with increases in circulating levels of plasma procoagulants like fibrinogen, prothrombin, Factor VII, Factor VIII, and Factor X, which lead to an increased risk for thrombosis [14-16]. In women who use OCPs and are known carriers of coagulation genetic deficiencies, the risk of venous thromboembolism is 2 to 9 times higher than those women who are carriers but do not use OCPs. Importantly, this finding is also associated with a 4% annual residual risk [17]. Though the relative risk is extremely high, the estimated residual risk is still very low at 28-50 cases per 10,000 women-years [18]. While our patient has no known genetic coagulation disorder, interestingly her sister also developed thrombosis after bariatric surgery.

Conclusion

We report a case of septic microthrombi to the brain and abdominal vasculature in a patient status-post bariatric surgery. In patients with rapid neurologic changes after bariatric surgery, septic thrombi should be suspected and ruled out. A thorough workup should also be done to identify concurrent presence of thrombus in other locations.

TEACHING POINT

Thrombus formation and septicemia are possible consequences of bariatric surgery. In the setting of symptoms inconsistent with a normal post-operative course, septic thrombi should be considered in the differential.

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FIGURES

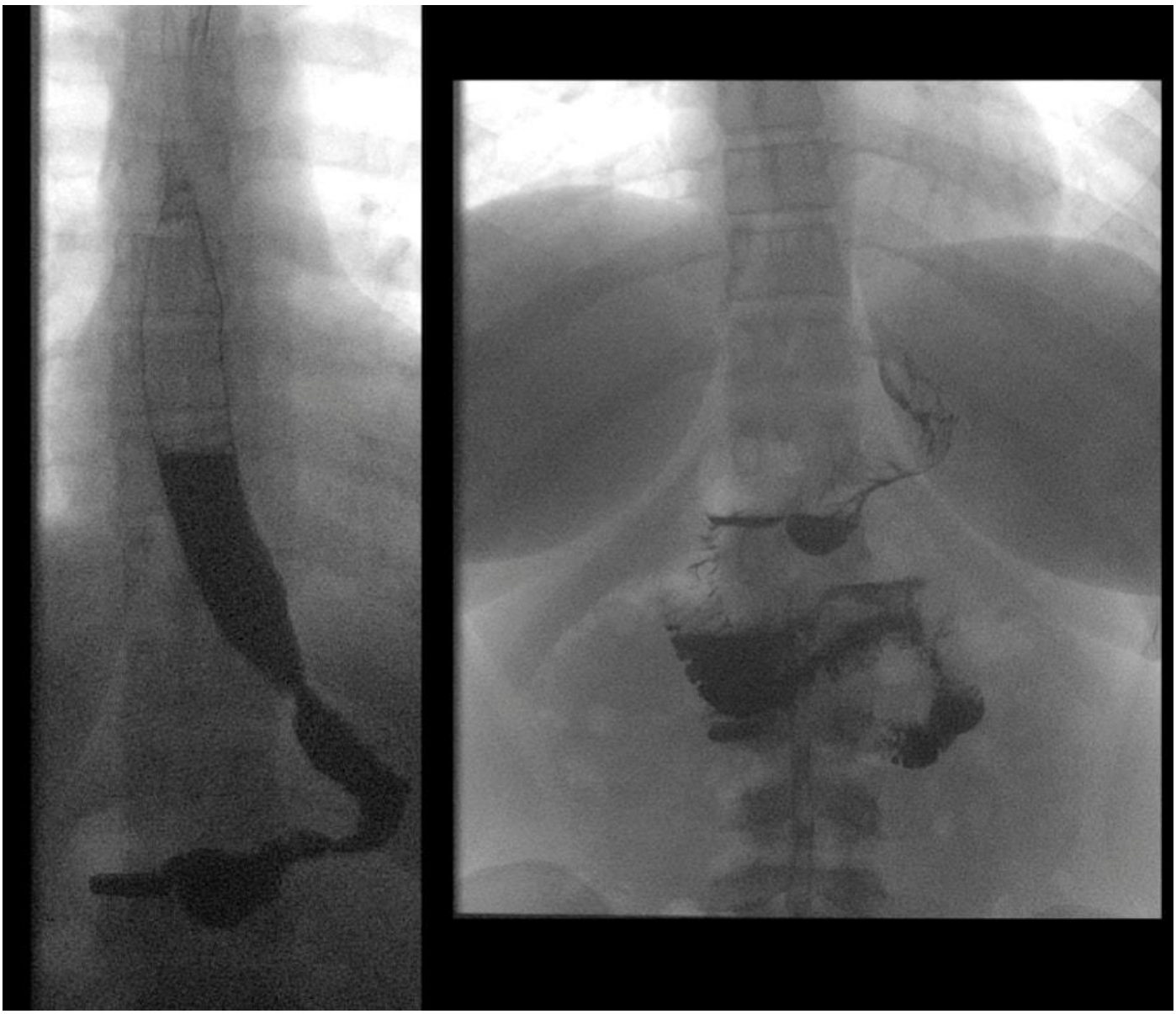


Figure 1: 21 year old female status post sleeve gastrectomy with vomiting.
TECHNIQUE: Patient was given thin oral barium contrast to swallow under fluoroscopic observation. Multiple spot radiographs were obtained of the esophagus, stomach, and duodenum. Fluoro time (min) =000.4. Dose area prod (uGym^^2) = 153.12. Entrance dose (mGy) = 5.10
FINDINGS: The patient swallowed barium without difficulty. The esophagus is normal in distensibility and contour. Contrast passes readily into the stomach and then subsequently into the duodenum without evidence of obstruction or delay. Gastric and duodenal mucosal fold patterns are within normal limits. No hiatal hernia is present. Appropriate postoperative appearance status post sleeve gastrectomy without evidence of leak, stricture, or gastric outlet obstruction.

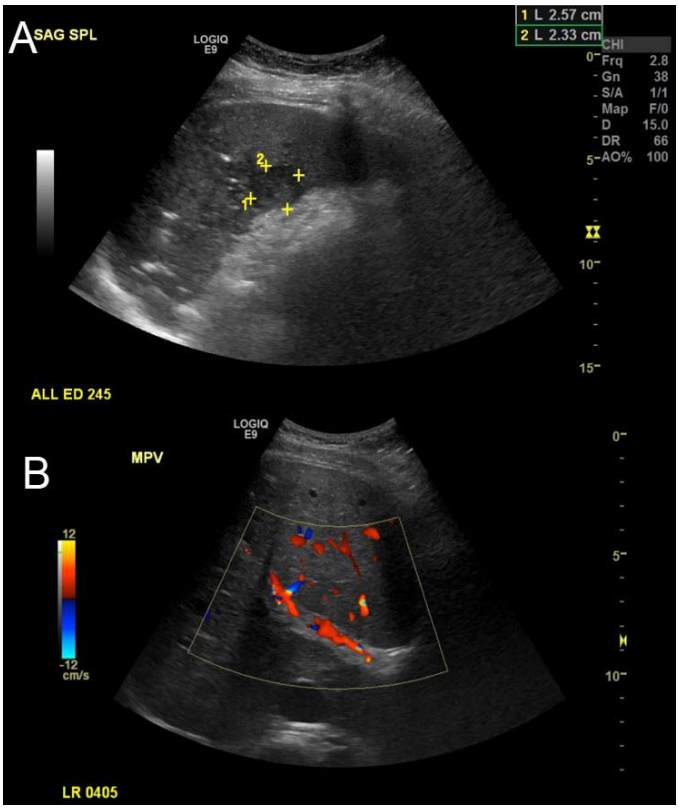
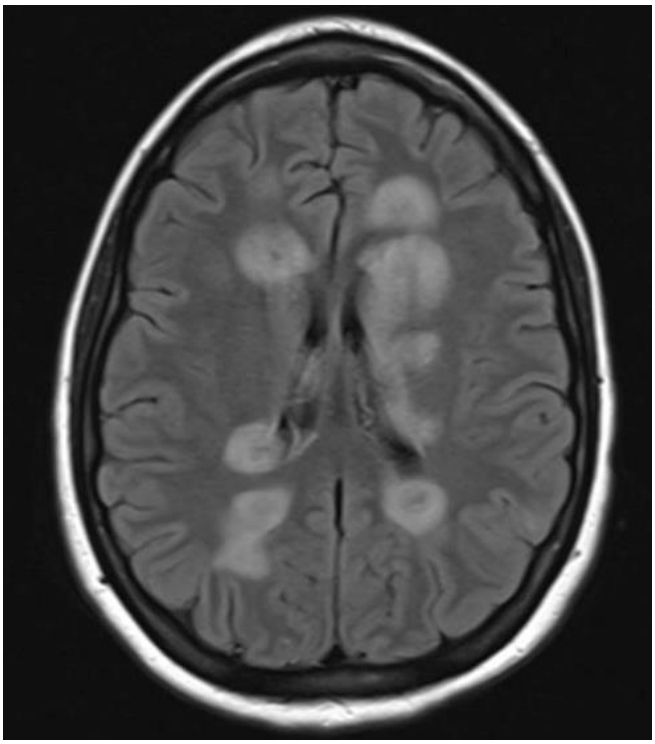


Figure 2: 21 year old female with splenic vein thrombosis and portal vein thrombosis
TECHNIQUE: Ultrasound, curved abdominal transducer, 2.8 MHz
FINDINGS: A) Sagittal view of the spleen with ultrasound revealing patchy hypoechoic areas and no demonstrable flow in the splenic vein. The thrombus (widest dimensions marked by arrows) measures 2.57cm x 2.33cm.
Spleen - Enlarged, size 14.8 cm.
B) Liver - Normal. Doppler of portal veins showed no demonstrable flow in the portal veins



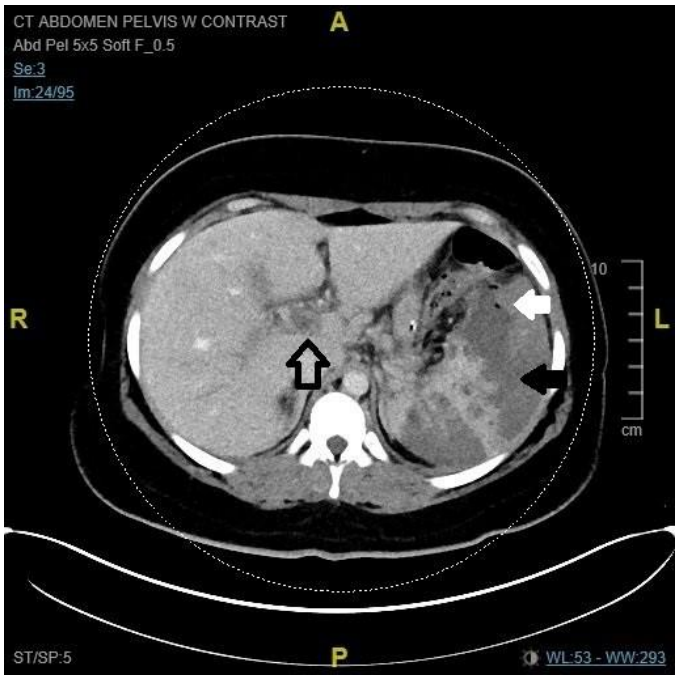


Figure 3: 21 year old female with multiple abdominal thromboses
TECHNIQUE: Abdomen, axial Multidetector Computed Tomography, delayed phase axial images, 364 mAs, 80 kV, 0.6mm slice thickness intravenous administration of 100 mL Omnipaque 350 iodinated contrast, oral contrast was administered.
FINDINGS:
Axial intravenous and oral contrast-enhanced CT of abdomen and pelvis demonstrates significant clot burden and splenic infarcts. Portal vein thrombus (up arrow), multiple areas of hypodensity representing splenic infarct (black arrow), and associated gas concerning for abscess (white arrow) are all seen.
There is complete thrombosis of the intrahepatic portal veins, main portal vein, splenic vein, as well as the central portion of the superior mesenteric vein at the confluence. There are no focal liver lesions seen. Gallbladder appears unremarkable. Adrenal glands appear unremarkable. There is soft tissue stranding adjacent to the pancreas, with mild edema of the pancreas. No pancreatic ductal dilatation. There are multiple large areas of hypodensity within the splenic parenchyma, many of which with large locules of gas within, some of which appear to demonstrate rim enhancement.

Figure 4 (left): 21 year old female with sudden onset diplopia, ataxia, and hemiparesis.
TECHNIQUE: Brain, multiplanar, multisequence, axial, MRI, 1.5 T, 8.5 mL intravenous Gadavist contrast, images obtained post-contrast
FINDINGS: T2 FLAIR of the brain demonstrating multifocal ring-enhancing lesions concerning for microabscesses. Overall, findings are consistent with scattered infarctions with halos of surrounding T2 signal. There is no evidence of hydrocephalus or midline shift, although the ventricles are mildly effaced by mass effect from the adjacent lesions. Paranasal sinuses, mastoids and orbits are unremarkable. There are no extra-axial collections.

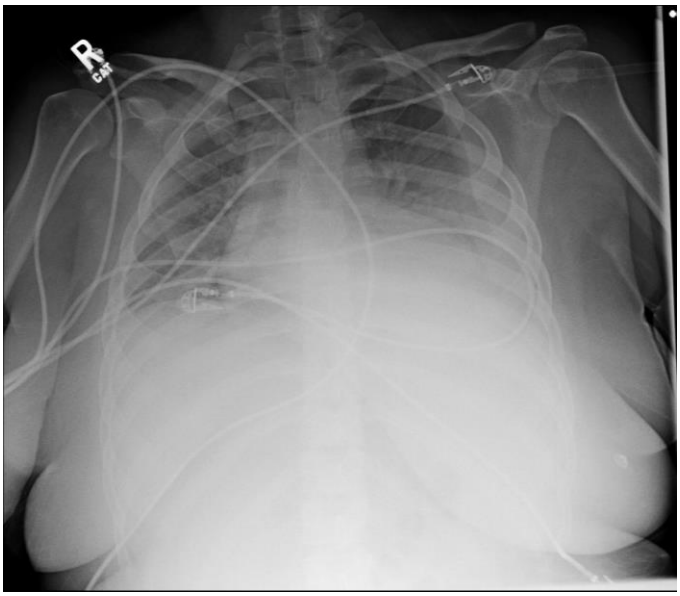


Figure 5: 21 year old female with new onset shortness of breath
TECHNIQUE: Chest X-ray, Anterior Posterior
FINDINGS: Small right pleural effusion and moderate-sized left pleural effusion with patchy atelectasis in both lower lobes. The heart is normal in size. No pneumothorax is seen.

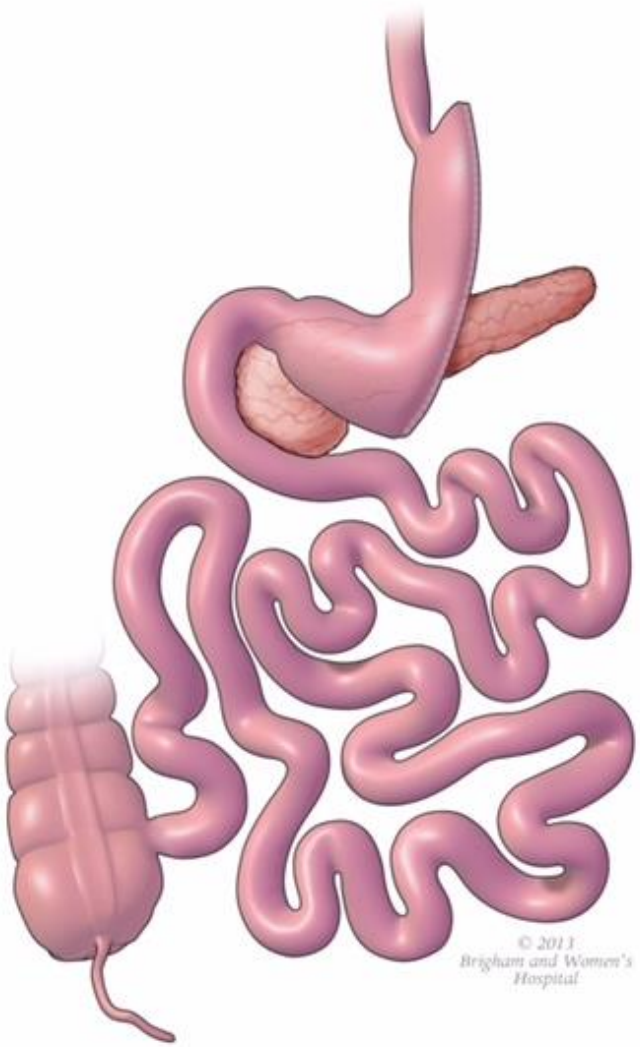


Figure 6 (right): Sleeve Gastrectomy Anatomy
During this operation, there is resection of the greater curvature of the stomach without any anastomoses made. No manipulation of the pancreas nor of the intestinal tract is made during this operation. Typically, the stomach is resected with a stapler, and so the resected edge will reveal staples on imaging.

Etiology	Septic microthrombi
Incidence	Unknown
Gender Ratio	Unknown
Age Predilection	Unknown
Risk Factors	Recent surgery, septicemia, hypercoagulability, oral contraceptive use
Treatment	Antibiotics, anticoagulation
Prognosis	Dependent on time to initiation of antibiotics, extent of microthrombi
Findings on Imaging	Ultrasound: spleen with extensive hyperechoic mass in the vasculature. CT abdomen/pelvis: small amount of pelvic free fluid, extensive hyperattenuated lesions within the abdominal vasculature, hypoattenuated collections with foci of gas MRI: T2/FLAIR bilateral hyperintense lesions with thick rims of enhancement and varying sizes

Table 1: Summary table for brain microabscesses.

Differential Diagnosis	**Imaging Findings**		
	Ultrasound	**Radiography**	**MRI**
Septic Microthrombi	Hyperechoic masses on imaging with possible acoustic shadowing	CT showing hyperattenuated lesions, variable collections with foci of gas	Hyperintense lesions with or without rim enhancement
Necrotic Abscess	Hyperechoic mass with heterogeneity	CT with hyperattenuated lesions with foci of gas	Hyperintense lesions with foci of gas

Table 2: Differential diagnosis table for brain microabscesses.

ABBREVIATIONS

BMI: Body Mass Index
ED: Emergency Department
OCP: Oral Contraceptive Pill

KEYWORDS

brain microabscess; thrombus; bariatric surgery; sleeve Gastrectomy; thrombus

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