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CASE REPORT | STOMACH

Gastric Volvulus: A Delayed Surgical Complication After Debulking and Hyperthermic Intraperitoneal Chemotherapy for Advanced Ovarian Cancer

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ABSTRACT

Gastric volvulus in conjunction with diaphragmatic hernia is an uncommon but life-threatening presentation that is generally in association with hiatal hernia or diaphragmatic injuries. Diaphragmatic hernia with gastric volvulus can occur many years after cytoreductive surgery and hyperthermic intraperitoneal chemotherapy despite initial diaphragm intactness, and should be suspected in this patient population when they present with upper gastrointestinal obstruction. An acute episode of gastric volvulus can have a mortality of 30% to 50%, hence the importance of early diagnosis and treatment. Surgical management remains the treatment of choice and can be an emergency in obstructive cases. We report the case of a 68-year-old woman presenting with signs and symptoms of acute upper gastrointestinal obstruction. Three years ago, the patient had undergone debulking surgery and hyperthermic intraperitoneal chemotherapy for peritoneal carcinomatosis secondary to advanced ovarian cancer. A diagnosis of gastric volvulus was established. The pylorus was seen near the cardia on gastroscopy, and barium swallow showed stomach upside down and with a mirror image of normal anatomy suggestive of gastric volvulus. We opted for urgent laparotomy that revealed the presence of a rotated stomach adherent to the spleen and left diaphragm. After reduction, a diaphragmatic defect that was missed on the computed tomography scan was discovered and repaired, and the patient recovered uneventfully.

KEYWORDS: gastric volvulus; diaphragmatic hernia; cytoreductive surgery; hyperthermic intraperitoneal chemotherapy

INTRODUCTION

Eventration of diaphragm is an abnormal elevation of a portion or entire hemidiaphragm, most often due to a developmental abnormality of the diaphragm musculature.[1] This provides the potential for gastric volvulus which is a rare entity defined as an abnormal rotation of the stomach around its short or long axis leading to variable degrees of gastric obstruction.[2] An acute episode of gastric volvulus can have a mortality of 30 to 50%, hence the importance of early diagnosis and treatment.[3]

We report a case of a 68-year-old patient presenting 3 years postcytoreductive surgery and hyperthermic intraperitoneal chemotherapy (HIPEC) with gastric outlet obstruction and found to have a gastric volvulus secondary to diaphragmatic eventration.

CASE REPORT

A 68-year-old woman known to have advanced ovarian cancer complicated with peritoneal carcinomatosis diagnosed in December 2018 presented to our institute. The patient received neoadjuvant chemotherapy and then underwent interval debulking in February 2019. Intraoperative evaluation showed peritoneal carcinomatosis involving the pelvis, the omentum, and the undersurface of both diaphragmatic domes leading to a peritoneal cancer index, according to Sugar baker of 14. The patient underwent pelvic peritonectomy with total hysterectomy and bilateral salpingo-oophorectomy, appendectomy, omentectomy, and bilateral subphrenic peritonectomy yielding a completeness of cytoreduction score of 0. After operation, HIPEC was given with 40 mg mitomycin C over 90 minutes using the closed abdomen technique. She received 5 cycles of adjuvant chemotherapy.

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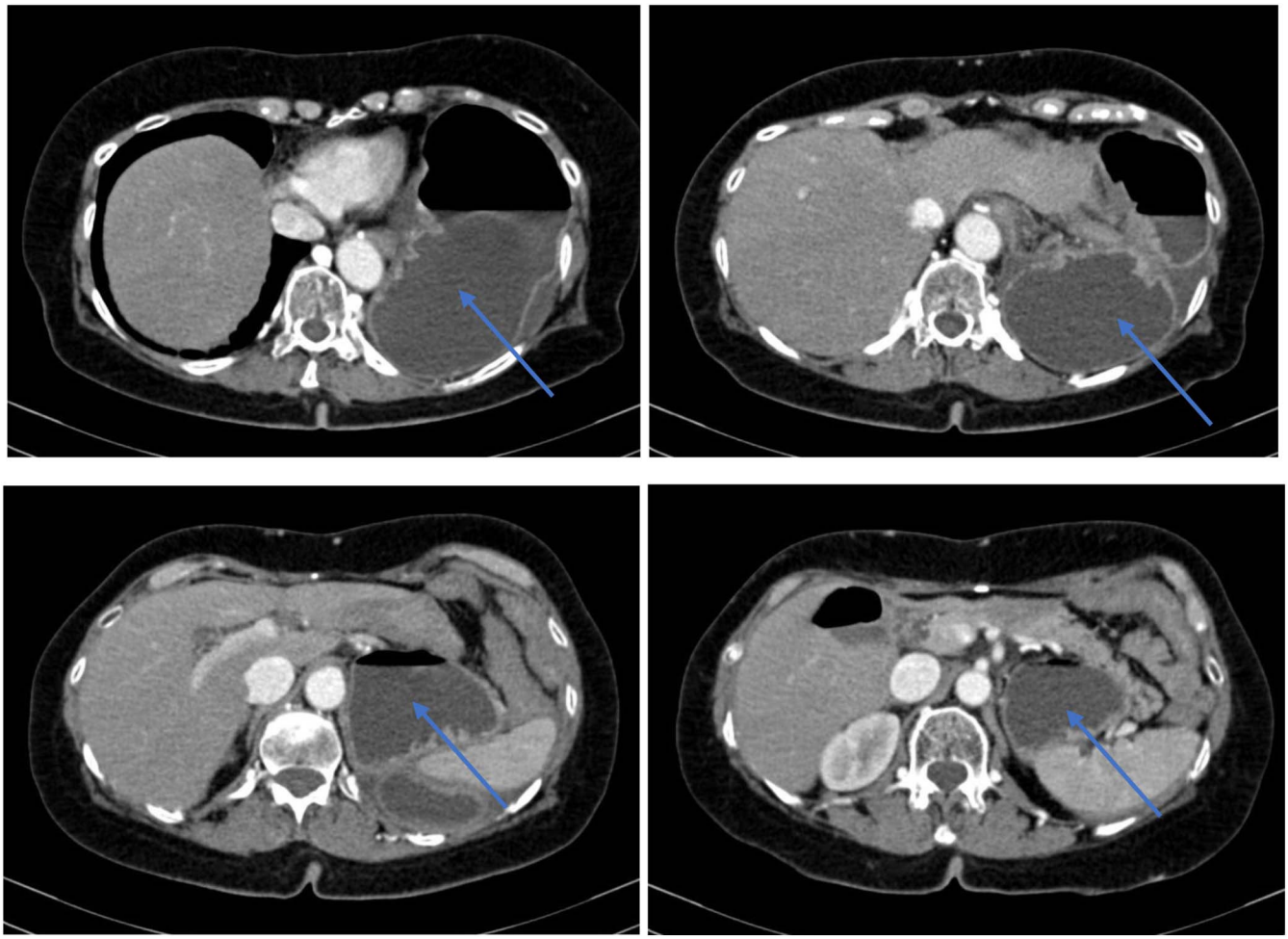

Figure 1. Transversal view of the abdominal and pelvic computed tomography scan showing significant gastric distension with the air fluid level proximal to the antropyloric region (blue arrow).

The patient was doing regular follow-up with the positron emission tomography scan and CA 125 and was in remission till June 2021, when she was readmitted for intestinal obstruction that was treated conservatively. During this event, the abdominal and pelvic computed tomography (CT) scan showed marked dilatation of the jejunal and ileal loops with a transition zone possibly located in the right lower quadrant, the stomach is not distended, and no diaphragmatic hernia was seen. We also noted the presence of moderate ascitic fluid surrounding the small bowel loops and perigastric region. Ascitic TAP cytology was taken and returned positive for cancerous cells compatible with the known ovarian cancer of the patient.

The patient received 5 new cycles of chemotherapy with Avastin and Carboplatin-Taxol between July 2021 and September 2021. The follow-up positron emission tomography scan in November 2021 was negative, and the patient was put on Femara which she did not tolerate, so she was switched to Arimidex.

On March 2022, this patient presented to our emergency department with a 2-day history of abdominal pain, nausea, recurrent retching, nonbilious vomiting with food content, constipation, and back pain radiating to the chest with no other complaints. On physical examination, the abdomen was soft, nondistended with epigastric tenderness, hypoactive bowel sounds, and a huge incisional hernia from the previous surgery. Vitals were stable. Laboratory results were within the normal range. The abdominal and pelvic CT scan with intravenous contrast showed significant gastric distension with the air fluid level proximal to the antropyloric region with collapse of the duodenum and distal bowels (Figure 1).

First, nasogastric tube decompression was performed and drained 2 liters of water and food content without bile. Then, a gastroscopy was performed and showed the pylorus near the cardia in favor of gastric volvulus or rotation (Figure 2). The gastroscopy was completed with a barium swallow that confirmed the presence of a gastric volvulus and rotation. The contrast was seen in the duodenum and proximal bowel loops after 11 minutes, suggestive of stasis in the stomach with a reflux reaching the upper third of the esophagus (Figure 3).

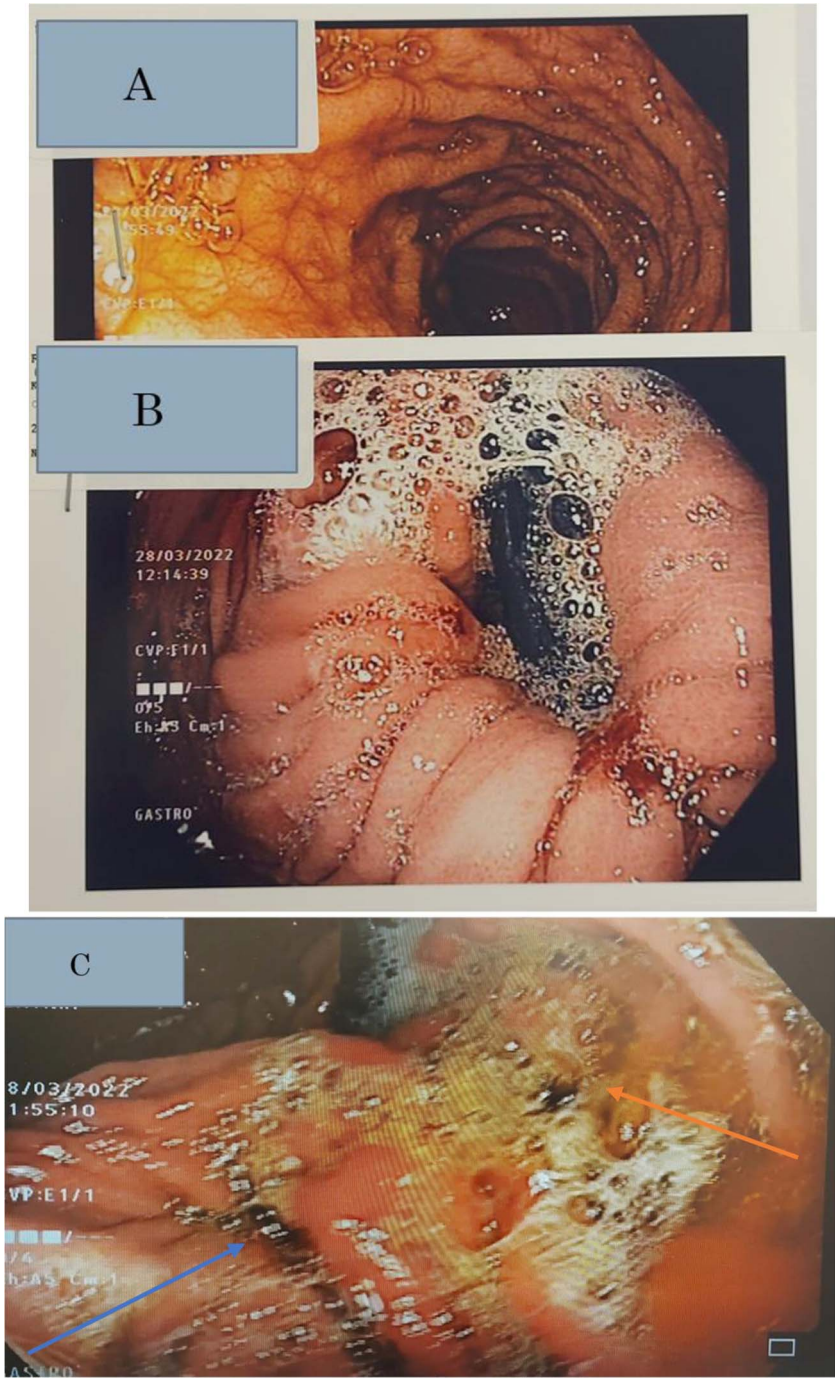

Figure 2. Gastroscopy showing (A) duodenum, (B) pylorus, and (C) pylorus (blue arrow) near the cardia (orange arrow).

The patient was scheduled for urgent surgery. A midline laparotomy was performed where a large incisional hernia was encountered from the previous surgery, and multiple peritoneal deposits were identified. After careful adhesiolysis, the gastric volvulus was visually confirmed and was adherent to the spleen and left diaphragm. After reduction of the stomach, we noted the presence of a huge left diaphragmatic eventration which allowed the stomach to move through the thoracic cavity and lead to the gastric volvulus. The diaphragm was plicated primarily using a continuous full thickness suture using polydioxanone 1, and a chest tube was inserted. A gastropexy was performed on the left side, and the large incisional hernia was repaired using PDS 1 interrupted figure of 8 sutures (Figure 4). Pathology of peritoneal deposits returned positive for metastatic deposits of a tubulopapillary adenocarcinoma consistent with the known primary cancer in the ovary. The postoperative course was uneventful. The patient soon recovered completely and was discharged on day 6 postoperative (Figure 5).

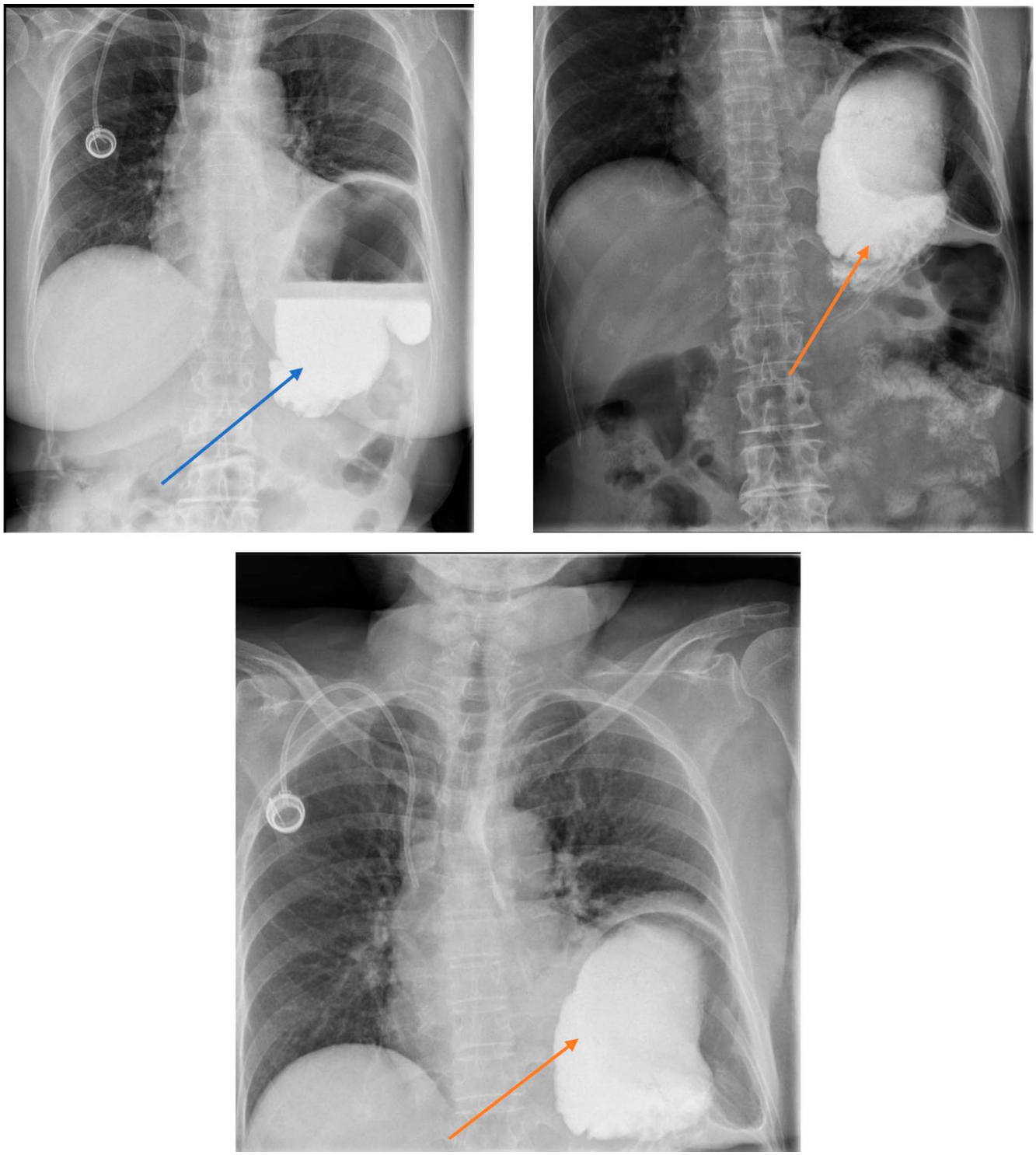

Figure 3. Barium swallow showing stomach upside down (blue arrow) and with a mirror image of normal anatomy (orange arrow) suggestive of gastric volvulus/rotation.

DISCUSSION

Gastric volvulus is a rare entity defined by an abnormal rotation of the stomach around itself.[1] The mortality rates for acute volvulus range from 30% to 50%, highlighting the importance of early diagnosis and treatment.[3] Classic symptoms of acute gastric volvulus are known as Borchardt triad which consist of retching without vomiting, severe epigastric pain, and inability to pass nasogastric tube.[4] This complication is sometimes overlooked until strangulation of hernial content occurs. Gastrointestinal symptoms can predominate when

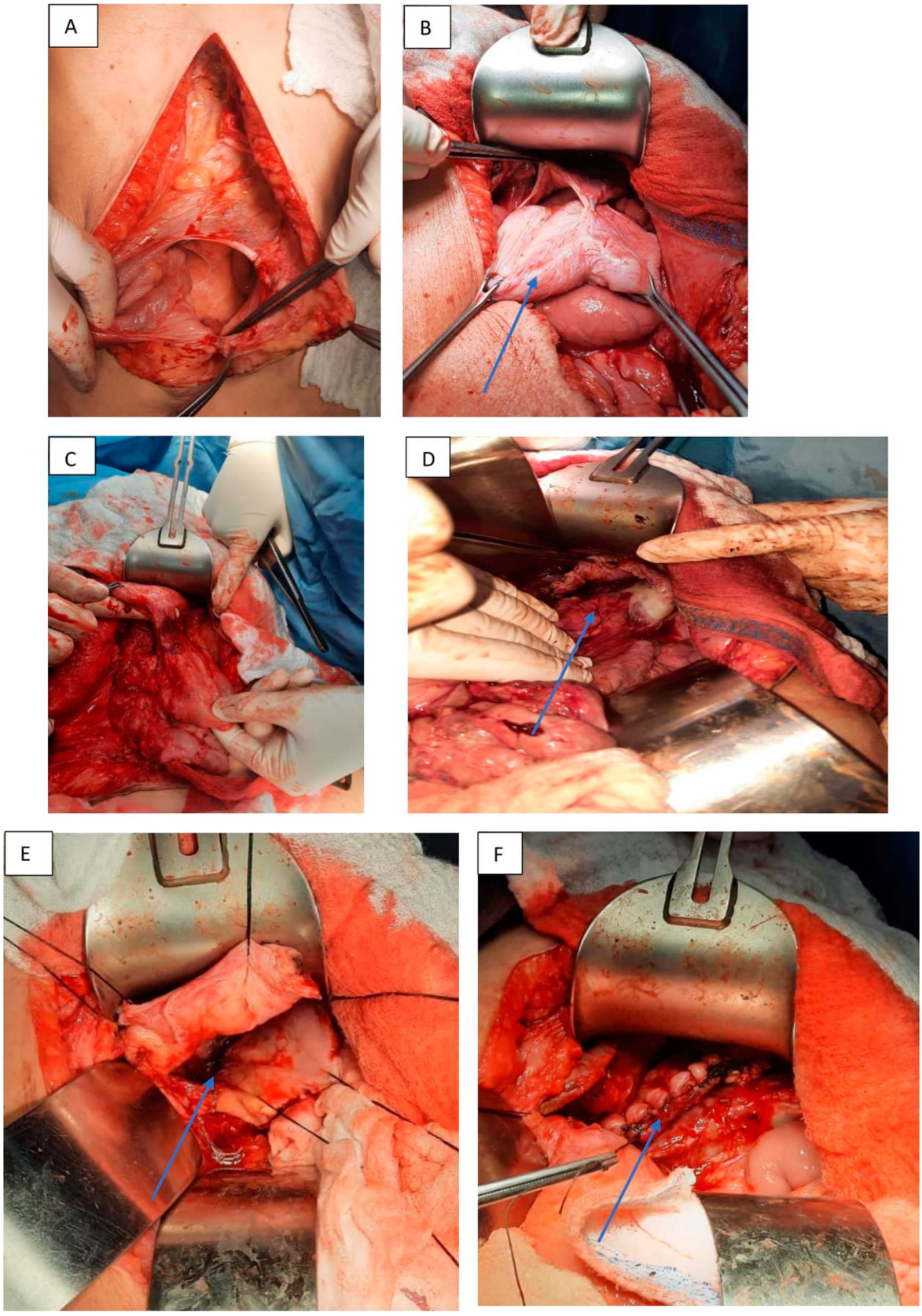

Figure 4. (A) Large abdominal defect; (B) gastric volvulus adherent to the spleen and left diaphragm: stomach (blue arrow); (C) gastric volvulus and adhesions; (D, E) left diaphragmatic eventration (blue arrow); and (F) closure of the diaphragm using a continuous full-thickness suture with PDS 1 (blue arrow).

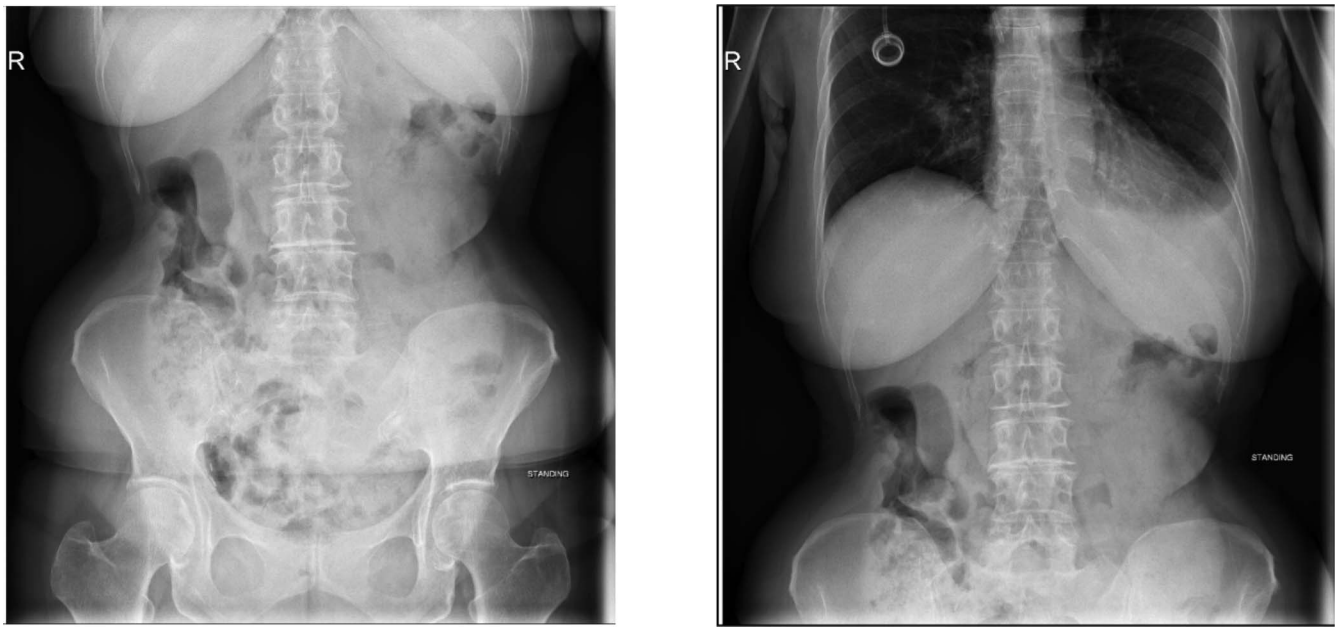

Figure 5. Postoperative kidney-ureter-bladder.

diaphragmatic eventration is associated with gastric volvulus with intermittent or complete outlet obstruction.[5] In our case, the patient presented with symptoms of gastric obstruction and in an acute setting. The diagnosis of gastric volvulus is usually based on barium studies. Plain radiographs may give a clue to suspect this condition, and the abdominal CT scan can confirm the diagnosis which shows a rotated stomach with the pylorus higher than gastro-esophageal junction.[6] In our case, the CT scan was not sufficient to have a diagnosis because it only showed gastric outlet obstruction, so a barium swallow test was needed to confirm the diagnosis of volvulus. Endoscopy also helped to visualize the volvulus, so it can be considered as a mean to diagnose gastric volvulus. Diaphragmatic eventration associated with gastric volvulus is a surgical emergency and always requires surgical repair. Abdominal subcostal incision allows good access to both diaphragms for plication, anterior gastric

Table 1. Literature review of all the diaphragmatic hernia postcytoreductive surgery reported in the reviewed literature

Publication	Age	Sex	Clinical presentation	Etiology	Diagnosis	Timeline	Treatment
Lampl et al[8]	36	M	Incidental finding on regular follow-up, chest pain, and dyspeptic disorder	Left diaphragmatic hernia	CT	N/A	Surgical
Lampl et al[8]	65	M	Pleural effusions, left-sided pneumonia with elevated inflammatory markers	Anastomotic leak of the left colonic flexure communicating with the left hemithorax	Incidental finding in surgery	2 wks	Surgical
Caronna et al[10]	51	F	Gastric outlet obstruction	Gastric volvulus secondary to left diaphragmatic hernia	Incidental finding in surgery	1 mo	Surgical
Mestre el al.[5]	19	F	Abdominal pain, vomiting, and watery diarrhea	Gastric volvulus secondary to left diaphragmatic hernia	CT	4 mo	Surgical
Ehmann et al[9]	36	F	Nausea and vomiting	Gastric incarceration secondary to left diaphragmatic hernia	CT	5 mo	Surgical
Ehmann et al[9]	50	F	N/A	Left diaphragmatic hernia	N/A	18 mo	Surgical
Ehmann et al[9]	45	F	Incidental finding on regular follow-up. Initially asymptomatic then developed belching and infrequent right upper discomfort	Gastric incarceration secondary to left diaphragmatic hernia	CT	6 mo	Surgical
Ehmann et al[9]	56	F	Incidental finding on regular follow-up	Left diaphragmatic hernia	CT	8 mo	Surgical

CT, computed tomography; N/A, not available.

fixation through a gastropexy or gastrostomy and allows abdominal exploration for associated gastrointestinal anomalies.[7]

In our case, gastric volvulus was due to diaphragmatic eventration after cytoreductive surgery related to advanced ovarian cancer. Peritoneal invasion is a common feature in patients with primary, advanced, or recurrent ovarian cancer. The volume of residual disease is an important prognostic indicator in patients with advanced ovarian cancer. For a desirable surgical outcome, the patient should undergo an extensive cytoreductive surgery to obtain microscopic residual disease. An aggressive surgery, as in other peritoneal carcinomatosis, including HIPEC, is needed. The most frequent complications of cytoreductive surgery and HIPEC are anastomotic leakage, digestive perforations, fistulas, and abscesses. Diaphragmatic complications are rare but should be considered, especially when peritonectomy of the upper quadrants was performed, even in the absence of diaphragmatic resection.[8] In patients with advanced ovarian cancer, the diaphragm is frequently involved and generally must be stripped or resected to achieve complete gross resection. Although the most common complication after diaphragm peritonectomy/resection during debulking is symptomatic pleural effusion, a very rare complication is herniation of the stomach or bowel through the diaphragm into the thoracic cavity.[9]

To date, only 8 cases of diaphragmatic hernia postcytoreductive surgery were found after a review in the literature performed using the PubMed engine[5,8–10] (Table 1). The male-to-female ratio was 1:3, and age at presentation ranged from 19 to 65 years. Five cases report diaphragmatic hernia postcytoreductive surgery for ovarian cancer,[5,9,10] 2 cases postsurgery for pseudomyxoma peritonei,[5,8] and 1 case postcytoreductive surgery for gastric cancer.[8] Four of these cases underwent HIPEC,[5] and 4 patients presented with gastric volvulus as our case. Three of the cases presented with signs of intestinal obstruction as was our case; otherwise, the others were incidental findings.[5,9,10] Two of the cases were diagnosed intraoperatively as was our case; however, the rest of the cases were identified preoperatively using the computed tomography scan.[5–8] Time from cytoreductive surgery to diaphragmatic hernia presentation was 2 weeks to 1 and a half year, and our patient had a late presentation after 3 years. All were treated surgically like our case.

The etiology of diaphragmatic eventration after cytoreductive surgery and HIPEC can be explained by multiple mechanisms. First, diaphragmatic peritonectomy leads to thinning of the diaphragm and might cause some ischemia, which makes it more vulnerable to herniation. In addition, a HIPEC procedure, even for a short time with the closed abdomen technique, can cause intra-abdominal pressure to increase and in turn might put a patient who has received peritonectomy of the diaphragm at higher risk of developing a diaphragmatic hernia. Second, neoadjuvant chemotherapy may increase friability of the diaphragm and risk of complications.[10]

A hernial defect will not close on its own and will likely only expand over time; thus, intraoperatively, the diaphragm must be checked for defects using the "bubble test." The patient is positioned in Trendelenburg, and the upper quadrant is filled with normal saline. Air bubbles with inspiration indicate a defect in the diaphragm. Even the smallest defect should be closed primarily to prevent the possible development of a hernia or other sequelae, such as pneumothorax or bowel strangulation and incarceration. The thoracoabdominal pressure gradient will lead to widening of the diaphragmatic defect, allowing abdominal contents to herniate into the thoracic cavity. A monofilament, nonabsorbable, or long-lasting absorbable suture such as polypropylene or polydioxanone suture can be used to repair a diaphragm defect.[9]

In this article, we present a case report of diaphragmatic hernia with gastric volvulus 3 years after cytoreductive surgery and HIPEC. This complication is very rare, and according to the available data, it usually presents months after management. This case report proves that diaphragmatic hernia with gastric volvulus should be on the differential even years after cytoreductive surgery and HIPEC. Surgical management remains the treatment of choice and can be an emergency in obstructive cases.

DISCLOSURES

Author contributions: All authors participated in the writing and editing of the article. Raja Wakim is the article guarantor.

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Data availability: All data available upon request at Department of General Surgery, Mount Lebanon Hospital University Medical Center, University of Balamand, Beirut, Lebanon, where the work was done.

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