What Is Too Big? Uterine Artery Embolization of a Large Fibroid Causing Abdominal Compartment Syndrome

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Case Report

A 39-year-old woman with a history of spastic cerebral palsy, mental retardation, and chronic worsening nausea and vomiting presented to the emergency department from a group home with complaints of hematemesis. The patient was admitted to the hospital and underwent an upper endoscopy, which revealed a nonbleeding ulcer that was treated medically. The patient was advanced to a liquid diet and promptly became symptomatic again with nausea and guaiac-positive emesis. After further discussion with her caregivers, it became clear that the patient's nausea and vomiting had been worsening before her admission. At this point, the patient's prior radiologic studies were reviewed for a possible etiology.

The patient had a computed tomographic (CT) scan of the abdomen and pelvis 5 months earlier that demonstrated multiple, large uterine fibroids, the largest measuring 16 cm × 10 cm × 10 cm (► Fig. 1). After multiple studies including an upper endoscopy, the gastroenterologist concluded that the patient's hematemesis was likely due to reflux esophagitis from mass effect by the fibroids. The gynecologist was consulted regarding treatment for the large fibroids. A repeat CT of the abdomen and pelvis was performed that again demonstrated a multifibroid uterus with one prominent fibroid, unchanged from the previous study. Of note, the small bowel was unremarkable on this CT scan.

The patient's gynecologic workup was delayed, as the patient was transferred to the intensive care unit (ICU) for methicillin-resistant *Staphylococcus epidermidis* bacteremia, during which time the patient had a peripherally inserted central catheter placed and was started on total parenteral nutrition. Once the patient was medically stabilized, the gynecologist was again consulted and Lupron therapy was initiated for treatment of her fibroids. The patient's hospital stay was further confounded by a biopsy of a left breast mass noted on mammography, which turned out to be a phyllodes

tumor; in addition, she was treated for an unrelated *Clostridium difficile* infection during her admission.

The patient's nausea and vomiting continued to progress, at which point gastroenterologist was again consulted. The gastroenterologist felt that a feeding gastrostomy tube was not indicated, as the patient's symptoms were likely related to small bowel obstruction from the uterine fibroids. Interventional radiologist placed a gastrojejunostomy tube, after which the patient was placed on wall suction due to continued symptoms and high gastric outputs. After improvement of her symptoms, tube feeds were initiated; this caused increased nausea and vomiting, again leading to the theory that her fibroids were causing mechanical obstruction. A repeat CT of the abdomen and pelvis was performed, which demonstrated a small bowel obstruction as a result of her uterine fibroids (► Fig. 2).

The patient was scheduled for a hysterectomy and left mastectomy but developed a fever (temperature, 101.3°F) and became hypotensive to 77/46 mm Hg. Multiple blood cultures drawn at this time were positive for *Candida parapsilosis*, and the surgery was canceled. Further workup revealed a vegetation on the mitral valve; however, cardiothoracic surgery determined the patient was too cachectic to proceed with operative repair. After approximately 2-month hospital stay, the patient was discharged to her group home on tube feeds, Reglan, and Prevacid, and instructed to follow up with interventional radiologist for evaluation for uterine artery embolization (UAE), as she was deemed too poor a surgical candidate for hysterectomy.

Approximately 2 months later, the patient had a magnetic resonance imaging scan of the pelvis, again demonstrating the multifibroid uterus with a large pedunculated fibroid (► Fig. 3). She subsequently underwent bilateral UAE. Upon initial aortic injection, markedly enlarged bilateral uterine arteries were seen, the right greater than the left, as well as a hypervascular enlarged fibroid uterus and a prominent right

Figure 1 (A) Axial contrast-enhanced CT of the abdomen demonstrates a large heterogeneous mass (arrow) consistent with leiomyoma. This fibroid measured 16 cm × 10 cm × 10 cm and was the largest in a multifibroid uterus. (B) Axial contrast-enhanced image from the same CT as A, below the level of the aortic bifurcation, demonstrating multiple large heterogeneous masses in the pelvis consistent with a multifibroid uterus. (C) Axial contrast-enhanced CT of the pelvis demonstrating mass effect on the bladder (white open arrow) and rectum (white solid arrow) by the multifibroid uterus (star). CT, computed tomography.

Figure 2 (A) Axial contrast-enhanced CT of the abdomen and pelvis showing the most cephalad portion of the fibroid (star) as well as many dilated fluid- and air-filled loops of small bowel (arrow) consistent with a small bowel obstruction. (B) Axial contrast-enhanced CT of the abdomen and pelvis again demonstrating multiple dilated air- and fluid-filled loops of small bowel with a large fibroid. CT, computed tomography.

Figure 3 Sagittal postcontrast MRI of the abdomen and pelvis before embolization demonstrating the large pedunculated fibroid (arrow) and multifibroid uterus (star). MRI, magnetic resonance imaging.

Figure 4 (A) Initial aortogram demonstrates bilateral markedly enlarged uterine arteries, the right (arrow) greater than the left (arrowhead). Also note the tortuous prominent right ovarian artery (white arrow). (B) Angiogram, midarterial phase, demonstrates a hypervascular mass consistent with markedly enlarged fibroid. (C) Delayed angiogram demonstrates large hypervascular fibroid as well as hypervascularity within the pelvis consistent with a multifibroid uterus with a dominant superior fibroid (arrow) as shown in the CT images. CT, computed tomography.

ovarian artery (►Fig. 4). The left uterine artery was embolized with two vials of 355 to 500 μm of polyvinyl alcohol (PVA) particles; the right uterine artery was embolized with two vials of 355 to 500 μm , four vials of 500 to 710 μm PVA particles, and $\frac{1}{2}$ packet of gel-foam made into a slurry. At the end of the procedure, minimal flow was seen in bilateral uterine arteries, although slightly more flow was seen in the right uterine artery when compared with the left (►Fig. 5).

Following the procedure, the patient continued to have nausea, vomiting, and abdominal pain. Three days post-UAE, the patient was noted to have increasing abdominal distension and pain; the following day, the patient deteriorated even further and was found to have free intraperitoneal gas on the abdominal radiographs (►Fig. 6). General surgery was

consulted for an acute abdomen and the patient was urgently transferred to the surgical ICU with hypotension, tachycardia, and dyspnea requiring intubation. After large volume resuscitation, the patient was taken urgently to the operating room.

In the operating room, the patient was found to have copious amounts of murky-free peritoneal fluid, a complete sigmoid colonic obstruction with a zone of transition in the region of the descending/sigmoid colon due to compression from the enlarged uterine fibroid, and several areas of ischemic small bowel. These findings were consistent with abdominal compartment syndrome (ACS). Intraoperatively, the gynecologist was consulted and performed a myomectomy to treat the obstructing fibroid which measured 17.5 cm $\times$ 14

Figure 5 (A) Angiogram following embolization demonstrates markedly reduced opacification of the hypervascular fibroid. Residual sluggish flow was noted in the right uterine artery (arrowhead). Incidentally noted is severe vasospasm of the right superficial femoral artery with complete cutoff (arrow). (B) Restoration of flow to the right superficial femoral artery (arrow) is seen after injection of 50 μg of intra-arterial nitroglycerine. Upon completion of the case, there were good distal pulses.

Figure 6 (A) Supine portable radiograph of the chest demonstrates a lucency over the liver in the right upper quadrant (arrow) concerning for free intraperitoneal gas. (B) Follow-up lateral decubitus radiograph of the abdomen shows diffuse dilatation of the colon measuring up to 10 cm in diameter.

cm $\times$ 9.2 cm, larger than the preprocedure imaging demonstrated, and pedunculated extending off the fundus of the uterus. The patient also underwent a total colectomy and partial small bowel resection to remove the ischemic segments. The surgeons were unable to primarily close the abdomen, so the patient was transferred to the ICU with an open abdomen. The patient subsequently underwent multiple abdominal washouts in the operating room, and further resection of small bowel with a new ileostomy created. The patient was ultimately able to undergo primary closure after multiple attempts.

After recovery, the patient was discharged to a skilled nursing facility. She continued to have severe intestinal paresis, ultimately making enteral nutrition impossible. The patient was readmitted several times for bacteremia and fungemia, and ultimately 1.5 years after her UAE the patient was provided comfort care only and died.

Discussion

Uterine fibroids are the most common benign tumors of the female reproductive system and can cause marked symptoms including anemia, dysmenorrhea, menorrhagia, pelvic pain, and other symptoms related to mass effect. Symptoms are often severe enough to require interventions; approximately 300,000 hysterectomies are performed yearly to treat fibroids, making it the most common indication for hysterectomy.¹ Uterine fibroids can be submucosal, intramural, subserosal, or pedunculated in location. Since 1995 when the first case was published, UAE has become a popular alternative to hysterectomy and myomectomy for the treatment of symptomatic fibroids.^{2,3} UAE is minimally invasive with a generally low risk of complications.⁴

While UAE is usually well tolerated with a low-risk profile, there are several well-documented adverse events. The most common side effect is postembolic syndrome, a flu-like illness consisting of pelvic pain, fever, malaise, and leukocytosis.^{1,4} This can be observed in up to 15 to 30% of patients undergoing UAE,⁵ and can usually be treated with oral analgesia and antipyretic medications. There are several less common, well-documented complications including pulmonary embolus, deep vein thrombosis, hematoma, uterine ischemia, uterine necrosis, transcervical expulsion of the fibroid, infection, ovarian dysfunction, and fibroid regrowth.^{1,3,4} Currently, there are 6 reported deaths in the literature from UAE, with a reported rate of 1 in 10,000 compared with the published mortality rate of 5 to 38 in 10,000 from hysterectomy. Of the reported deaths, two were due to sepsis, one in the United Kingdom and the other in the Netherlands,^{6,7} and three from pulmonary embolism.^{8,9} There is one unpublished but reported case of a woman in Italy with breast cancer who underwent UAE and subsequently had a pulmonary embolism, however, the etiology of which is unclear given her significant comorbidities.¹⁰

There are mixed reports in the literature of the effect of the size of the fibroids on procedure outcomes and adverse events. Larger fibroid volume has been associated with less improvement in patient symptoms and volume reduction after embolization.¹¹ Multiple cases have been reported in the literature of patients experiencing severe complications after UAE for large uterine fibroids. One of the previously mentioned reported deaths was of a patient with multiple uterine fibroids and a 14-cm submucosal fibroid; she died 10 days after embolization from septicemia.⁷ There have been multiple reports in the literature of patients with large fibroids requiring a hysterectomy after UAE due to infection and pain.¹²⁻¹⁵ This has led to the opinion that embolization of large fibroids has an increased risk of adverse events, and publications have reported thresholds of fibroids over 10 cm in diameter or a fibroid uterus greater than 24 weeks' gestation as contraindications to UAE.¹⁵⁻¹⁷ To the contrary, other retrospective studies have found equivalent outcomes with no significant increase in adverse events following UAE of large fibroids.^{12,16}

The current case is, to the authors' knowledge, the first reported case of UAE causing ACS. ACS is defined as elevated

intra-abdominal pressure causing organ dysfunction.¹⁸ ACS is also defined as an intra-abdominal pressure of ≥ 20 mm Hg (normal intraperitoneal pressures range from 0 to 5 mm Hg), with dysfunction of at least one thoracoabdominal organ system.¹⁹ It has been shown that mesenteric blood flow and oxygenation decreases as the abdominal pressure increases; this impaired oxygenation to the bowel is seen without equivalent reductions in the adjacent subcutaneous tissues.²⁰

There are many risk factors that predispose a patient to ACS including trauma, hemoperitoneum, pancreatitis, major abdominal surgery, burns, large volume fluid resuscitation, and sepsis.²¹ The respiratory and renal systems are usually the first affected, as increased intra-abdominal pressure also causes elevation and stenting of the diaphragm. This decreased compliance and increased airway pressure cause restrictive physiology, usually leading to respiratory failure as seen in this patient.^{19,21}

The patient presented here had several risk factors that predisposed her to developing ACS, including an intra-abdominal procedure, systemic illness, and large volume resuscitation. The patient clinically demonstrated findings consistent with ACS (a very tense distended abdomen, respiratory failure, and organ dysfunction), although due to her decompensation an intra-abdominal pressure was never obtained. Upon surgical exploration, it was felt that the findings were consistent with ACS.

This patient underwent embolization of a 16 cm $\times$ 10 cm $\times$ 10 cm fibroid that was causing an intermittent small bowel obstruction. On surgical pathology, the mass was found to be 17.5 cm $\times$ 14 cm $\times$ 9.2 cm and consistent with leiomyoma. As this was larger than any of the preprocedure imaging, it suggests postprocedure swelling of the fibroid as a major contributing factor to the development of ACS.

The current literature is divided as to the use of UAE for large uterine fibroids, and it is the authors' opinion that this current case raises caution for large fibroid embolization.

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