



Uterine Leiomyomata as a Cause of Abdominal Compartment Syndrome in the Postpartum Period

Mason Hui, DO¹ Baha Sibai, MD¹ Alvaro Montealegre, MD¹ Mateo G. Leon, MD¹

¹Department of Obstetrics, Gynecology, and Reproductive Sciences, McGovern Medical School at The University of Texas Health Science Center at Houston, Houston, Texas

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Address for correspondence Mason Hui, DO, Department of Obstetrics, Gynecology, and Reproductive Sciences, McGovern Medical School at The University of Texas Health Science Center at Houston, 6431 Fannin St MSB 3.286, Houston, TX 77030 (e-mail: mason.hui@uth.tmc.edu).

Abstract

Uterine leiomyomas are common benign smooth muscle tumors that often occur during the reproductive years. Although many cases may not result in significant complications, negative pregnancy outcomes have been associated with the size and location of the fibroids. Degeneration of fibroids can occur as early as the late first trimester when they undergo significant volumetric growth, contributing to pain during pregnancy. While myomectomy is typically avoided during pregnancy, conservative management with anti-inflammatory medications may be effective. Surgical removal or preterm delivery may be necessary if symptoms persist. Abdominal compartment syndrome (ACS) is a rare condition characterized by sustained elevated intra-abdominal pressure leading to organ failure. Although ACS resulting from large-volume leiomyomas in the postpartum period has not been previously described, we present a case of a 25-year-old patient with massive uterine fibroids who required indicated preterm delivery via primary cesarean section at 25 weeks gestation. Her postpartum course was complicated by ACS, requiring emergent surgical decompression. When a large fibroid burden is present during pregnancy or in the postpartum period, ACS should be considered in the differential diagnosis. Early diagnosis and timely surgical decompression are necessary to prevent organ dysfunction and worsening maternal outcomes.

Keywords

- ▶ uterine leiomyoma
- ▶ pregnancy
- ▶ postpartum
- ▶ abdominal compartment syndrome
- ▶ surgical decompression

Uterine leiomyomas are benign smooth muscle tumors that can have potential adverse effects on pregnancy.¹ The most common presenting symptom is abdominal pain, and larger fibroids can lead to obstetrical complications, such as preterm labor, preterm delivery, fetal malpresentation, and placental abruption.² Fibroids can also degenerate and contribute to significant pain during pregnancy, which can generally be controlled with conservative measures such

as pain medications, hydration, and rest.³ Surgical management in pregnancy or the peripartum period is generally avoided, but can be performed safely in individualized cases.^{4–6}

Abdominal compartment syndrome (ACS) is a condition in which there is sustained elevated intra-abdominal pressure (IAP) leading to organ failure. The incidence of ACS varies significantly in the literature, ranging from 1 to 14%.⁷

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Risk factors include a history of trauma, abdominal surgery, burns, or post-surgical patients.⁸ Clinical presentation includes abdominal distension and findings of end-organ damage such as oliguria, increasing hypoxia, or evidence of hypoperfusion.⁹ The diagnosis can be made with measurement of IAP more than 20 mm Hg that is associated with new organ dysfunction.¹⁰

We describe a patient with multiple large volume degenerating uterine leiomyomas at 25 weeks gestation, showing signs of end-organ damage, and necessitating delivery via cesarean section. Her postoperative course was complicated by acute adynamic ileus and ACS, requiring emergent surgical decompression.

Case Presentation

A 25-year-old woman, G1P0, presented to multiple hospitals on seven separate occasions, starting at 9 weeks gestation, with severe abdominal pain. She was found to have multiple degenerating leiomyomas, in her uterus, including a 24 cm pedunculated fibroid occupying most of the lower abdominal space, a 9.4 cm intramural fibroid in the upper uterine body, and an 8.5 cm anterior fundal pedunculated fibroid, as well as several smaller subserosal and intramural fibroids. Clinically, her multifibroid uterus was palpable at her xiphoid process. Her pain was treated with a 48-hour course of nonsteroidal anti-inflammatory drugs and a patient-controlled analgesic pump of morphine. Her pain was controlled with these medications and then she was transitioned to oral medications of acetaminophen, indomethacin, and oxycodone. Despite this treatment, she continued to experience intermittent pain and presented to the hospital four more times between 19 and 23 weeks gestation, each time receiving pain medication and occasionally requiring intravenous morphine. It should be noted that since her first admission, the patient had requested to perform surgery to remove her fibroids due to the debilitating pain.

At 24 weeks and 3 days, she presented with acute right lower leg edema and abdominal pain and was admitted to the antepartum service. Lower extremity-Doppler studies for deep vein thrombosis were negative. Her vital signs demonstrated tachycardia (100–110 bpm) secondary to pain, mild range blood pressures (range: 120–130/80–90) but otherwise afebrile and normal respiratory rate. Imaging including a magnetic resonance imaging showed a massive 24 cm fundal fibroid compressing the upper abdomen and thoracic cavity during the second trimester (►Fig. 1). Her pain continued to worsen despite intravenous medications and narcotics, and she developed vomiting, lymphedema, and acute kidney injury due to the mass effect of her fibroid uterus. Laboratory values were significant for anemia with hemoglobin (Hb) ranging between 8.4 and 9.8 g/dL, and her creatinine levels had increased from a baseline of 0.7 to 1.16 mg/dL. Given her worsening clinical status, a multidisciplinary team meeting was held with maternal fetal medicine, gynecologic surgery, anesthesia, and neonatology, and it was decided to proceed with a primary cesarean section at 25 weeks and 3 days after administering betamethasone

injections for fetal lung maturity and magnesium infusion for fetal neuroprotection. She delivered a female infant weighing 925 g, and due to the size of her fibroids and the risk of severe hemorrhage, a decision was made not to perform a myomectomy at the time of the cesarean delivery.

Her postoperative course was complicated by acute blood loss anemia and adynamic ileus. She received a blood transfusion due to her anemia with Hb 7 g/dL, and was placed on bowel rest with nasogastric decompression for her ileus. Despite conservative measures, she continued to deteriorate clinically, and on postoperative day 4, her abdomen was massively distended, tense, and she demonstrated peritoneal signs on palpation (►Fig. 2). Given her worsening clinical status with signs of end-organ damage, there was a high clinical suspicion for ACS. She reported shortness of breath, bilateral lower extremity edema, and decreased urine output. Additional imaging was ordered and a computed tomography (CT) scan was performed, with findings showing massive multifibroid uterus with dilated loops of bowel, compression of the urinary bladder as well as bilateral hydronephrosis (►Fig. 3). She met criteria for oliguria, and her creatinine was trended but remained normal at 0.7 mg/dL. After discussing with the surgical team, the patient declined a myomectomy and desired to proceed with a hysterectomy to prevent future fibroid-associated symptoms and complications. She underwent an emergent decompressing laparotomy with evacuation of large volume ascites, total abdominal hysterectomy, and bilateral salpingectomy. The uterine weight was 9,290 g (►Fig. 4).

Postoperatively, patient suffered from acute blood loss anemia and was transfused a total of four units of packed red blood cells and one unit of fresh frozen plasma. Her postoperative Hb rose to 9.8 g/dL and remained stable with no clinical signs of bleeding or hemorrhage. Her postoperative course continued to be complicated by an adynamic ileus, which was suspected clinically and supported by a repeat CT scan. She was treated conservatively with bowel rest, and over the course of 6 days her ileus resolved. Her diet was progressively advanced from a clear liquid diet to a regular diet. As for her postoperative pain, the regional anesthesia team was consulted, and the patient received bilateral quadratus lumborum regional anesthetic blocks using continuous infusions through percutaneous catheters. She continued with oral pain medications with additional intravenous medications as needed for break through pain. Over the course of 6 days, the patient underwent clamp trials of the catheters until the patient was able to tolerate only intravenous and oral medications. Ultimately, the patient was meeting all postoperative milestones and tolerating oral medications on postoperative day no 13, when she was stable for discharge.

Since the patient delivered preterm at 25 weeks gestation, the female infant was admitted to the neonatal intensive care unit (NICU). She was admitted to the NICU for 3 months, where she was ultimately transitioned to home oxygen therapy. She was also noted to have a patent ductus arteriosus, which was ligated by the pediatric cardiology team. The infant made appropriate progress in the NICU until she was stable enough for discharge.

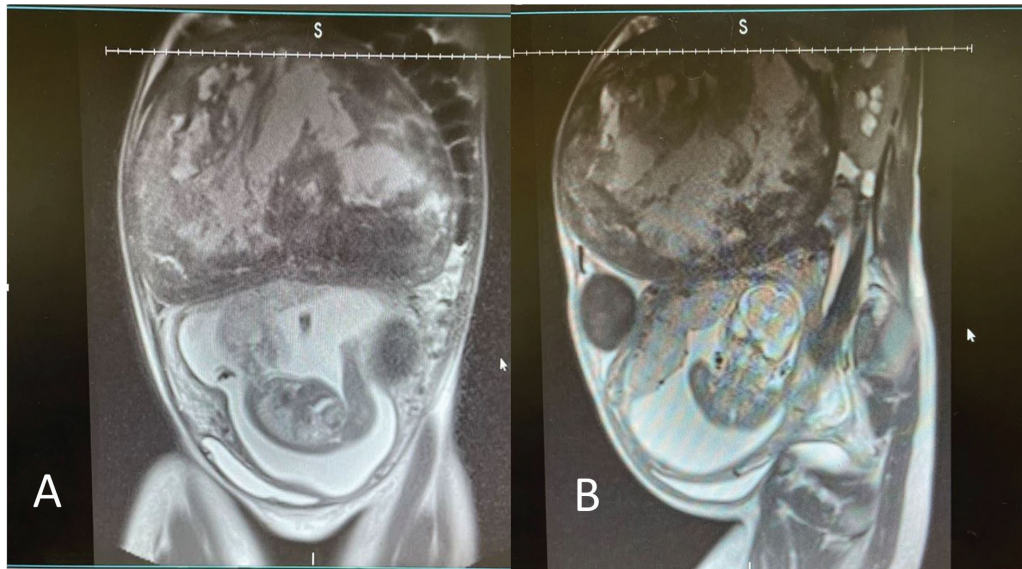


Fig. 1 (A) Magnetic resonance imaging (coronal) showing 24 cm fibroid uterus demonstrating external compression on the fundus with live intrauterine pregnancy at 23 weeks gestation. (B) Sagittal view.

Comment

To our knowledge, this is the first case whereby a massive fibroid uterus caused postpartum ACS requiring emergent decompressing surgery. Although a degenerating fibroid was initially considered as a possible cause of the patient's symptoms, the presentation of severe and tense abdominal distension and signs of end organ damaged suggested ACS as the more likely diagnosis. ACS is a clinical diagnosis that may or may not be supported by an IAP threshold of more than 20 mm Hg.¹¹ Given the abdominal exam findings, along with



Fig. 2 Abdominal compartment syndrome noted on postoperative day 4 after delivery from primary cesarean section.

oliguria, increasing hypoxia, worsening kidney function, vulvar and lower extremity edema, and overall evidence of hypoperfusion, the patient met criteria for ACS.¹² Initial management of ACS includes supportive measures and careful observation.^{13,14} However, in cases of ACS causing a surgical abdomen or organ dysfunction, surgical decompression is indicated.¹⁵

Fibroid prevalence in pregnancy can range from 1 to 10% and is generally asymptomatic.² However, these fibroids can cause significant pain leading to hospitalization in up to 11% of pregnant patients.¹⁶ Normal physiologic changes of pregnancy include increases in cardiac output and uterine blood flow with intra-abdominal volumes that are 1.5 times higher than outside of pregnancy. This is accompanied by a progressive increase in the size of the uterus, the placenta, and the amniotic fluid volume.¹⁷ Petrenko et al demonstrated a linear relationship between gestational age and intra-abdominal volume up to approximately 24 weeks gestation, at which time the relationship shifts to an exponential one.¹⁸ With increasing intra-abdominal volume and uteroplacental requirements relative to the gestational age, this can lead to fibroid degeneration as the growth of fibroids leads to its own hypoperfusion, causing tissue necrosis and ischemia.⁵ When this occurs, prostaglandins are released and patients experience pain. These symptoms are compounded as the growing uterus expands outside of the pelvis and into the abdominal cavity.

Management of leiomyomas depends on the time of diagnosis, location of fibroids, and clinical symptoms. Patients with fibroid uteri diagnosed prior to pregnancy can be managed medically or surgically. Most medical options preclude conception, and for fibroids that are diagnosed prior to pregnancy, surgical management is generally employed, especially if the patient is symptomatic.¹⁹ Location of the fibroid as well as fibroid size is key factor in determining whether prepregnancy surgical management is

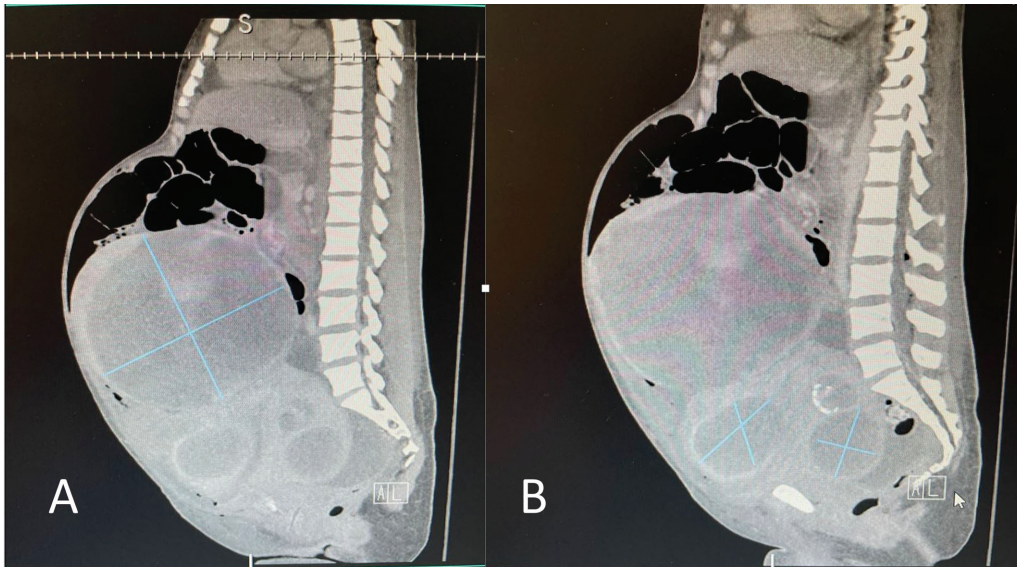


Fig. 3 Computed tomography (sagittal) imaging of massive multifibroid uterus with dilated loops of bowel and large volume ascites. (A) Largest subserosal fibroid measuring 24 × 17 cm. (B) Multiple smaller fibroids measuring 6.7 × 5.8 cm and 4.2 × 4 cm.

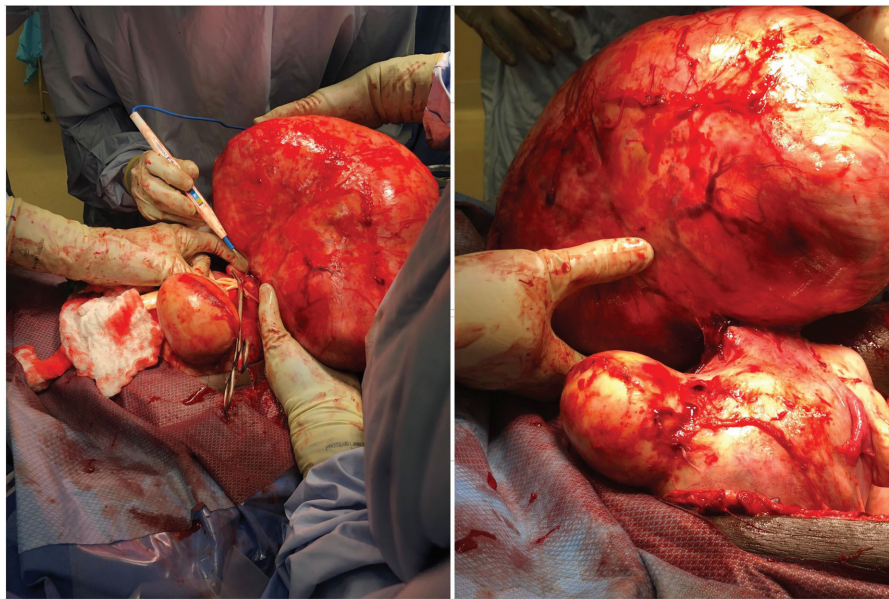


Fig. 4 Intraoperative findings of massive multifibroid uterus totaling 9,290 g.

needed. Submucosal fibroids can distort the endometrial cavity and can result in abnormal uterine bleeding, infertility, and pelvic pain; therefore, treatment is with hysteroscopic myomectomy to maximize fertility.²⁰ Patients who desire pregnancy and have intramural, subserosal, or pedunculated fibroids causing bulk symptoms can undergo a minimally invasive or open abdominal approach to myomectomy. Appropriate measures can be taken to help prevent future maternal and fetal complications for fibroids in pregnancy.

Complications of fibroid uteri in pregnancy include fibroid degeneration, miscarriage, preterm labor, preterm premature rupture of membranes, and placenta abruption.²¹ For patients who become pregnant and are diagnosed with fibroids on ultrasound or based on clinical symptoms, initial

management includes conservative measures such as anti-inflammatory medications, pelvic rest, and hydration.²² If the patient's pain is refractory to these initial modalities, the patient can be hospitalized for a short course of narcotic pain medications. If still no relief, epidural anesthesia can be considered.²³ Routine myomectomy during the antepartum period or at time of cesarean delivery is not recommended.⁴⁻⁶ This is due to the increased risk of severe hemorrhage that may necessitate hysterectomy; however, individualized care on a case-by-case basis for patients who have failed conservative management may be considered.²⁴ Antepartum myomectomy has been described as a safe procedure but the risks of significant morbidity due to hemorrhage must be considered.⁶ Therefore, cases are

individualized based on symptoms, fibroid size, location, and number of fibroids.

In this particular case, the patient underwent multiple admissions to the hospital for conservative management given her nulliparous state as well as her young age. She failed various pain modalities and continued with worsening pain of her fibroids. This patient had a multifibroid uterus, with the largest being a pedunculated 24 cm fundal fibroid, and multiple other large, intramural fibroids necessitating preterm delivery at 25 weeks gestation.

ACS is a rare outcome associated with benign gynecology. There is limited data regarding ACS as a complication from gynecologic issues and the current literature only shows case reports and small case series. Case reports have demonstrated ACS as a complication from massive ovarian cystadenomas, uterine artery embolization, or heterotopic ectopic pregnancies.^{11,25–27}

ACS is an excessive increase in IAP greater than 12 mm Hg that contributes to early organ dysfunction. The World Congress on Abdominal Compartment Syndrome grades ACS based on the IAPs—Grade 1: 12 to 15 mm Hg, Grade 2: 16 to 20 mm Hg, Grade 3: 21 to 25 mm Hg, Grade 4: more than 25 mm Hg.¹⁰ In pregnancy, IAPs can range from 10 to 15 mm Hg at baseline over a period of months. This is a normal, physiologic adjustment to a growing uterus and fetus. However, sustained increased IAPs can lead to multi-organ failure, including pulmonary, cardiovascular, renal, gastrointestinal, musculoskeletal, and nervous systems.²⁸ This is due to a shift in the abdominal perfusion pressure (APP), which is defined as the mean arterial pressure minus the IAP.²⁹ A target APP is 60 mm Hg that correlates with improved survival, and sustained increased IAP leads to reduced arterial perfusion to the abdominal viscera, resulting in organ failure.³⁰ More specifically, the renal system is subject to decreased renal perfusion pressures, which is critical with regard to glomerular filtration and perfusion.^{28,31} Decreased renal perfusion pressure leads to decreased renal function, prerenal azotemia, acute kidney injury, and ultimately renal failure.¹⁰ Oliguria can occur with an IAP of 15 mm Hg, and anuria at IAP of 30 mm Hg.¹⁰ With regard to the gastrointestinal system, the decreased APP results in hypoperfusion of the bowel that can lead to bowel ischemia, bowel edema, and sepsis.^{10,12}

Increased IAP also leads to elevation of the diaphragm, causing extrinsic compression on the lung and reducing compliance that is clinically manifested with shortness of breath, decreased oxygen diffusion, and hypercarbia. Similarly, the elevated diaphragm can extrinsically compress the cardiac ventricles, resulting in decreased stroke volume, decreased peripheral perfusion, and decreased venous return. Clinically, patients present with lower extremity edema, and potential deep venous thrombosis.^{10,30,32}

IAP can be measured using direct and indirect methods. With direct methods, this is performed with a needle puncture of the abdomen during laparoscopy or during peritoneal dialysis.¹⁰ Indirect methods include use of an intravesicular, intragastric, intracolic, or intrauterine pressure balloon catheter. The current literature suggests that intravesicular pres-

sure is the most widespread and common technique in evaluating IAP; however, there is no standardized way to measure it.

In our particular case, the giant fibroid was directly causing significant pain, abdominal distension, vulvar edema, bilateral lower extremity edema, and oliguria. Imaging confirmed extrinsic compression of the bladder and ureters, leading the hydronephrosis in addition to an adynamic ileus. We did not perform IAP measurements as the patient's clinical status worsened as described above. The treatment is abdominal decompression that was performed in a timely fashion.

In gynecology, massive, space-occupying lesions have been described to cause ACS, from extrinsic compression of abdominal contents and vasculature within the abdominal cavity.³³ Although ACS is a rare phenomenon, especially in benign gynecology, it should always be considered in the setting of large volume lesions in the peritoneal cavity, especially associated with the physiologic changes of pregnancy. The diagnosis is made with IAP along with signs of organ failure requiring prompt abdominal surgical decompression.

Informed Consent

The authors confirm that written permission from the patient on whom the report is based has been obtained.

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None.

Conflict of Interest

None declared.

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