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### Acknowledgements

Acknowledgements: The authors would like to thank the talented staff on the P2C unit – Interprofessional Partnerships to Advance Care and Education (iPACE) – at Maine Medical Center for their compassionate care for our patient, including at the end of life. The authors are grateful for the outstanding medical illustrations (Figure 2 and 3) created by Natalie Fuinha.

### Authors

Robert G. Michaud and Lesley B. Gordon

## CASE REPORT

# A Fatal Rectus Sheath Hematoma After a Myasthenia Crisis: A Case Report

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**Introduction:** Rectus sheath hematomas (RSH) are generally caused by damage to the inferior epigastric artery. They are rare causes of abdominal pain or acute anemia due to blood loss, but they are an important diagnostic consideration because they can be cryptic and potentially fatal.

**Clinical Findings:** An 85-year-old female who was admitted to the hospital for 10 days with a myasthenia crisis was abruptly hypotensive with a tender abdominal mass in the left lower quadrant that subtly crossed the midline. She was on prophylactic anticoagulation during her hospitalization.

**Diagnosis, Interventions, and Outcomes:** The patient was initially stabilized with fluids and given one unit of packed red blood cells. Results from a computed tomography angiography of her abdomen and pelvis showed a type III RSH. She underwent a percutaneous embolization of her inferior epigastric artery via interventional radiology. Unfortunately, she did not recover and was transitioned to hospice, where she died 1 day after discharge.

**Conclusion:** Classic teaching associates RSHs with systemic anticoagulation and a physical exam notable for a mass not crossing the midline. However, a wider range of presentations, including an abdominal mass that crosses the midline, can occur. Other important risk factors include frailty, immunosuppression, and possibly abdominal injections (particularly heparin).

**Keywords:** rectus sheath hematoma, abdominal injection, case report

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## CASE PRESENTATION

An 85-year-old female, whose medical history noted a recent diagnosis of myasthenia gravis, was transferred to our tertiary care hospital in a myasthenia crisis with increasing generalized weakness and respiratory failure. Her home medications included prednisone, but no antiplatelet or anticoagulant medications. Due to her declining respiratory status, she was intubated on hospital day 2. She was given 5 doses of intravenous immunoglobulin (20 g per dose) and methylprednisolone (1 g per dose). She remained on prophylactic anticoagulation throughout her hospitalization. She received subcutaneous abdominal injections of enoxaparin 40 mg daily at the outside hospital and then was transitioned to heparin 5000 units every 12 hours at our institution.

She received no other abdominal injections. She was extubated on hospital day 6, transitioned to prednisone 40 mg daily, and transferred to the general medicine unit. She was medically stable and being prepared for discharge to a skilled nursing facility.

On hospital day 11, she developed severe abdominal pain in her left lower quadrant. She was hypotensive to 80/50 mmHg (prior range: 140-170/60-80 mmHg), her extremities were cool, and she was somnolent. She had a new 3.5-cm firm, tender mass in her left lower quadrant that subtly crossed the midline. She was temporarily stabilized with 2 L lactated ringers and 1 unit packed red blood cells. Her hemoglobin dropped from 11.7 g/dL to 9.7 g/dL. Given our concern for intra-abdominal pathology, she underwent a computed tomography angiography of her abdomen and pelvis. The scan revealed a large hematoma that originated in the left rectus sheath, with active extravasation from the inferior epigastric artery, and expansion into

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the extraperitoneal space within the pelvis (Figure 1). Interventional radiology successfully embolized the inferior epigastric artery, but the patient had persistent hypotension after resuscitation and continued to decline. She developed ischemic hepatitis and acute renal failure. Given her continued decrease in consciousness and prior goals of care, she was transitioned to comfort measures and discharged to hospice. She died 1 day after discharge.

## DISCUSSION

A rare cause of abdominal pain is a rectus sheath hematoma (RSH), which accounts for approximately 1.8% of cases.<sup>1-4</sup> A RSH is a collection of blood within the aponeurosis of the rectus abdominis muscle that is due to damage to the epigastric artery or the rectus muscle.<sup>3,4</sup> The rectus abdominis muscles are separated by the linea alba, accounting for the unilateral nature of most RSHs. They are surrounded by the aponeuroses of the internal oblique, transversus abdominis, and external oblique muscles, which together form the rectus sheath.<sup>4,5</sup> The inferior epigastric artery is particularly vulnerable to injury because it runs along the posterior surface of the rectus abdominis muscle and then penetrates the rectus sheath at the arcuate line. This line is where the rectus sheath transitions from surrounding the rectus abdominis muscle to only running along the anterior surface (Figure 2).<sup>6</sup> Although RSHs can occur above the arcuate line, they are generally less severe and self-limited because the surrounding sheath tamponades the hematoma and prevents its expansion.<sup>7</sup> Thus, most RSHs occur in the lower abdominal quadrants and are often more severe.<sup>6,7</sup>

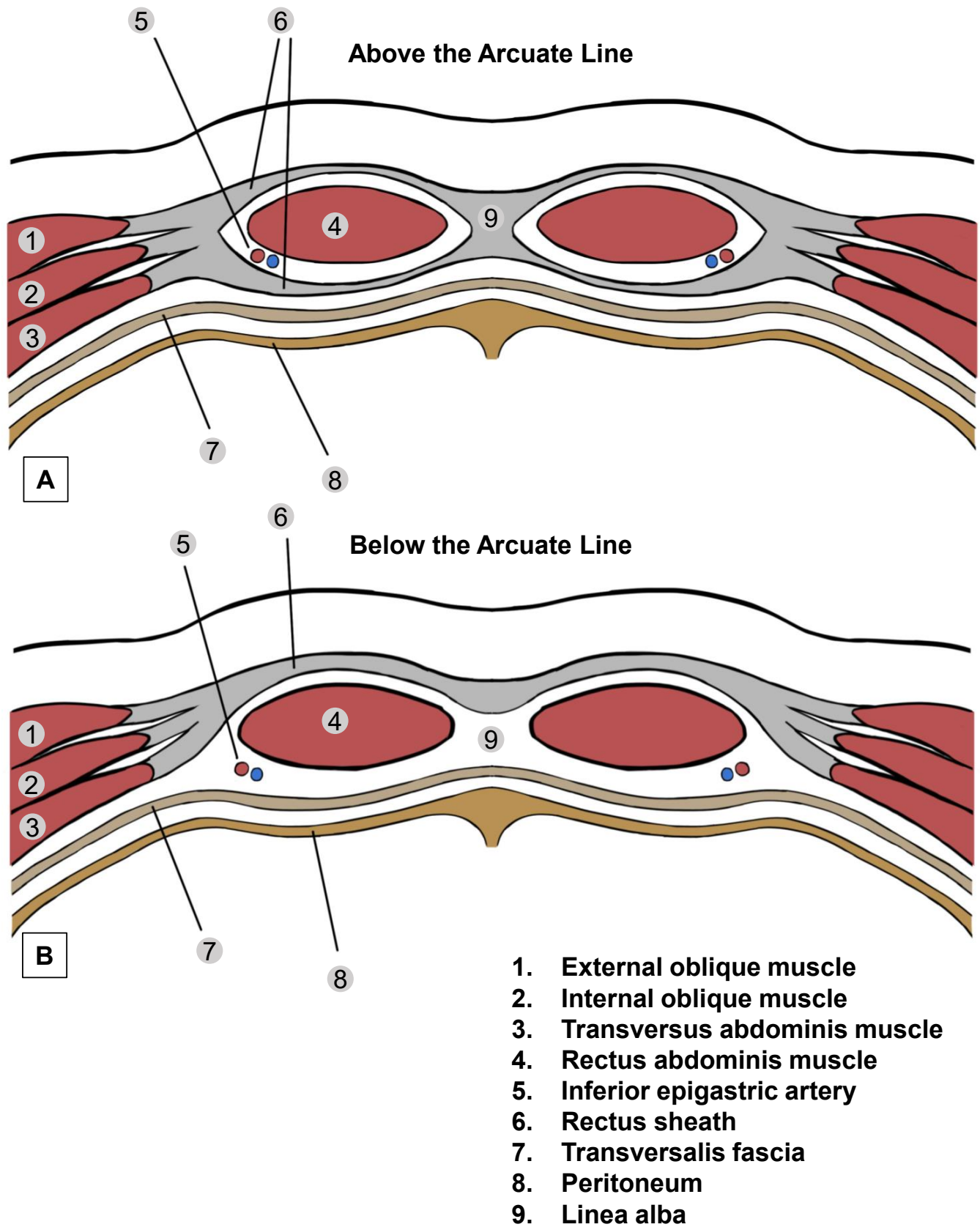
There are 3 types of RSHs (Figure 3). Type I hematomas are mild, intramuscular, and unilateral hemorrhages that do not lead to hemodynamic instability. These hematomas can be managed conservatively and generally resolve within 30 days.<sup>3,4</sup> Type II hematomas are larger, and the hemorrhage extends between the transversalis fascia and rectus abdominis. This hematoma can lead to a decreased hematocrit and may require bed rest, hemodynamic assistance, and analgesia. Type III hematomas, the most severe, are hemorrhages that extend to the peritoneum and perivascular space.<sup>3,4</sup> These hematomas generally require further hemodynamic assistance with blood transfusions and are more likely to need surgery

or percutaneous interventions.<sup>3,4</sup> Type II and III RSHs may cross the midline, involving both rectus muscles, and typically resolve within 3 months.<sup>3,4,6</sup> The average RSH volume or estimated blood loss varies widely. One study found that the mean volume ranged from 612.5 mL (SD = 225 mL) to 940 mL (SD = 371.5 mL). Another study found that it ranged from  $687 \pm 614$  mL among conservatively managed patients to  $2353 \pm 1657$  mL among patients who underwent embolization.<sup>8,9</sup>

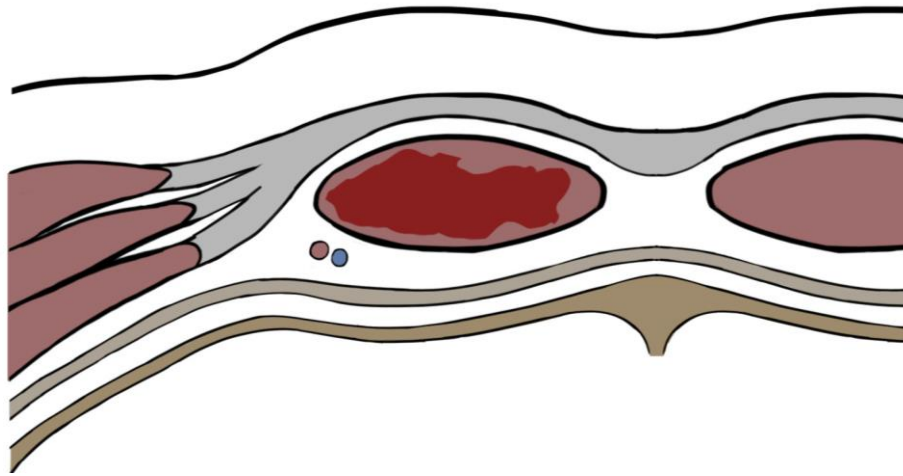
A review of 126 cases at a single medical center identified the top 5 presenting signs and symptoms of RSH, which included abdominal pain (84%), abdominal wall mass (63%), a decrease in hemoglobin by 0.4 g/dL or more (55%), abdominal wall ecchymosis (17%), and nausea or vomiting (15%).<sup>2</sup> Factors associated with RSHs included advanced age, systemic anticoagulation, chronic kidney disease (stage 3 or greater), steroid or immunosuppressant treatment, trauma, and abdominal injections. More recent cases also found abdominal wall straining (e.g., coughing) as a factor.<sup>1,2,4</sup> RSHs are two to three times more likely to occur in females than in males.<sup>1,2,4</sup>



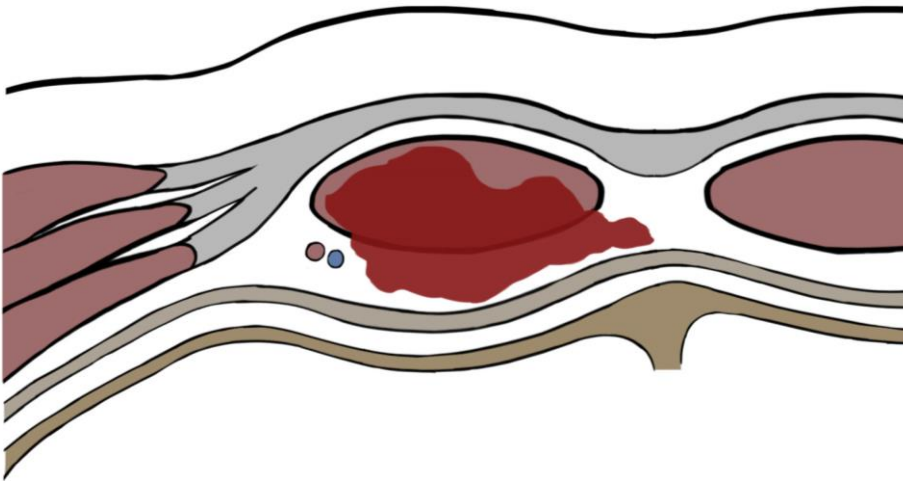
**Figure 1.** Computed tomography angiography of abdomen and pelvis. The scan revealed a type III rectus sheath hematoma that expanded into the extraperitoneal space within the pelvis. Arrow, contrast extravasation from the inferior epigastric artery.



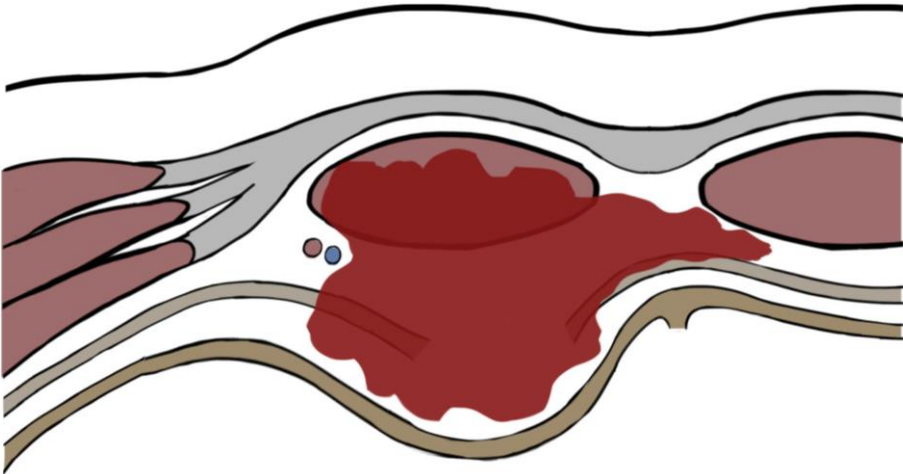
**Figure 2.** Axial illustration of the abdominal muscles surrounding the arcuate line. The abdominal muscles (A) above and (B) below the arcuate line at which the rectus sheath transitions from surrounding the rectus abdominis muscle to only covering the anterior portion.



A – Type I RSH



B – Type II RSH



C – Type III RSH

**Figure 3.** Illustration of the 3 types of rectus sheath hematomas in the axial view. A, Type I hematoma is within the rectus abdominis muscle. B, Type II hematoma extends outside the muscle and dissects the surrounding fascial layers. C, Type III hematoma extravasates to the peritoneum and perivascular space. RSH, rectus sheath hematoma.

Our patient was not given therapeutic anticoagulation. She was female, elderly, and given prophylactic heparin injections in her abdomen and pulse therapy doses of corticosteroids (defined as  $\geq 250\text{mg}$  of prednisone-equivalent per day). These factors likely increased her risk for developing a RSH.<sup>10</sup> Although RSHs tend to present as a unilateral mass, they can cross the midline, as demonstrated by this case. With the increasing prevalence of systemic anticoagulation, the occurrence of RSHs may increase.<sup>4</sup> RSHs are rarely fatal (~2-4% overall), but the fatality risk may increase in patients receiving anticoagulation treatment.<sup>2,4,6,11</sup> Physicians must carefully consider a RSH in patients who develop a painful abdominal mass, regardless of midline involvement, to ensure prompt diagnosis and treatment.

Prior case reports highlighted that RSHs may be associated with abdominal injections and steroids or immunosuppressants.<sup>1,12-14</sup> Systemic corticosteroids have been linked with spontaneous bruising and disrupted wound healing.<sup>15</sup> Future studies should investigate how corticosteroid dose may affect the development and outcomes of RSHs. Additionally, the association between abdominal injections and RSHs should be explored. If abdominal injections increase the risk of RSHs, this risk could be mitigated by choosing other locations (eg, thighs or upper arms) for prophylactic anticoagulation or insulin injections in the hospital.

**Conflicts of Interest:** None

**Acknowledgements:** The authors would like to thank the talented staff on the P2C unit – Interprofessional Partnerships to Advance Care and Education (iPACE) – at Maine Medical Center for their compassionate care for our patient, including at the end of life. The authors are grateful for the outstanding medical illustrations (Figure 2 and 3) created by Natalie Fuinha.

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