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Case Report
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Management of Splenic Artery Aneurysm during Labor

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Abstract

Introduction: The prevalence of Splenic Artery Aneurysms is reported to be between 0.01% and 10.4%; these visceral aneurysms are often discovered incidentally on imaging or when they rupture. Rupture of a splenic artery aneurysm is associated with a 2% mortality, which increases to 75% among pregnant women with a fetal mortality of 95%.

Case Presentation: A 29-year-old G4P3003 pregnant female, 33 + 4/7 weeks, presented with pain in the epigastrium and left upper quadrant. The pain had been present for three to four months, but became progressively worse over the few days prior to presentation to the emergency department. CT angiogram and ultrasound revealed splenic artery aneurysms measuring 2.3 cm and 1.9 cm. On admission, a multidisciplinary approach was taken and OB/GYN and general surgery were involved early in the care of this patient. On the day she was scheduled for IR embolization, fetal decelerations were noted on fetal monitoring which became more regular and prolonged and the patient began feeling regular contractions. Her cervix started to dilate, and she progressed into labor. There was fear she had high risk of rupture with Valsalva so the patient underwent cesarean section with the general surgeon in the room who proceeded with laparoscopic splenectomy once the abdomen was assessed for signs intra-peritoneal hemorrhage. The newborn had good APGARs and both mother and the newborn survived.

Conclusion: Splenic artery aneurysms are rare, and if they rupture, they are associated with a high maternal and fetal mortality rate. When a patient is diagnosed, action is necessary to ensure optimal maternal and fetal outcomes. In this case, we performed a laparoscopic splenectomy after cesarean section with great outcomes.

Introduction

Splenic Artery Aneurysms (SAAs) are rare and occur predominately in women. This condition is often asymptomatic and identification of SAAs is usually incidental [1-3]. SAAs are the third most common abdominal aneurysm, following the infrarenal aorta and the iliac artery, and they are the most common splanchnic vessel aneurysm [4,5]. Visceral Artery Aneurysms (VAAs) are defined as aneurysms of the celiac, SMA, or IMA, and their branches [6]. SAAs are the most common of these visceral artery aneurysms (60%), followed by the hepatic (20%), SMA (5.9%), and celiac (4%) artery aneurysms [2]. SAAs are discovered incidentally on imaging, autopsy, or when they rupture; rupture is associated with a 25% mortality rate in a non-pregnant adult; however, mortality increases to 75% in pregnant women with a fetal mortality of 95% [2,7]. Various anatomical and physiological changes occur during pregnancies that make diagnosis, evaluation, and treatment of pregnant women more challenging [2]. Surgical intervention prior to aneurysmal rupture is uncommon, with most reports describing identification of the aneurysm post rupture [8]. Although this is a rare disease, the risk of aneurysmal rupture is increased during pregnancy and due to the high maternal and fetal mortality, elective surgery should be performed when possible [9].

Case Presentation

A 29-year-old G4P3003 pregnant female, 33 + 4/7 weeks, presented with pain in the epigastrium and left upper quadrant. This pain had been present for three to four months, but became progressively worse over the few days prior to presentation to the emergency department. She reported good fetal movement, occasional cramping, denied vaginal bleeding or leakage of fluid. She further denied fever, chills, nausea, vomiting, and shortness of breath, chest pain, headache, blurry vision or RUQ pain. Physical exam was positive for LUQ tenderness. Imaging was performed, ultrasound and CT revealed splenic artery aneurysms measuring 2.3 cm and 1.9 cm (Figure 1). On admission, a multidisciplinary approach was taken and OB/GYN, vascular surgery, and general surgery were involved early in the care of this patient. The day she was scheduled for

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Figure 1: Coronal cut on CT scan showing 2.3 cm aneurysm in the distal portion of the splenic artery abutting the splenic hilum.

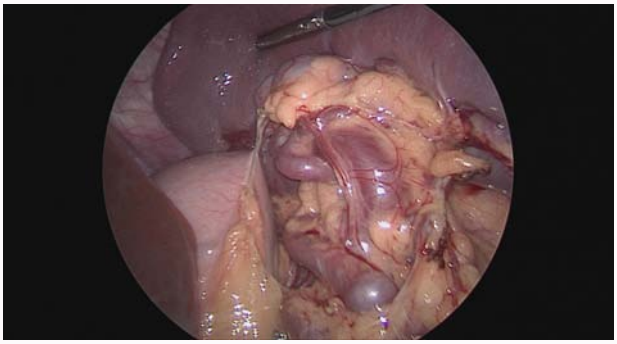

Figure 2: Intraoperative image of SAA involving the splenic hilum.

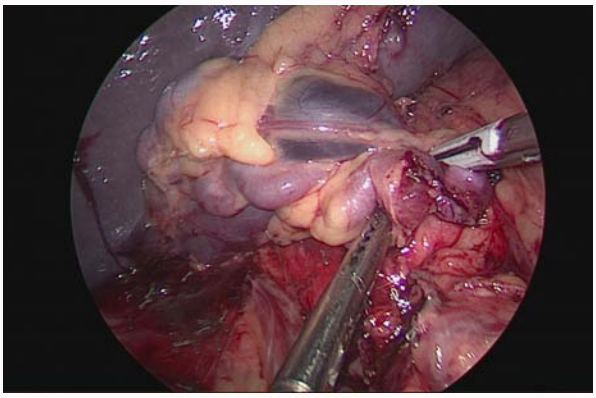

Figure 3: Intraoperative image after we stapled across the splenic artery and vein.

IR embolization, fetal decelerations were noted on the fetal monitor, who became more regular and prolonged and the patient began feeling contractions, which also became regular. Her cervix started to dilate, and she progressed into labor. There was fear she had high risk of rupture with Valsalva so the patient underwent cesarean section with the general surgeon in the room who proceeded with laparoscopic splenectomy once the abdomen was assessed for signs of intra-peritoneal hemorrhage (Figure 2 and 3). The newborn had APGARs of 8 and 5 at 1 and 5 min respectively, both mother and newborn survived.

Demographics

Splenic artery aneurysms are uncommon, but occur more frequently in women than men and are four times more common in multiparous women [2,10]. SAAs occur more often in younger patients, with 58% diagnosed in women of childbearing age; 95% of these are diagnosed during pregnancy [11]. The increased use of ultrasonography and high resolution imaging during pregnancy is attributed to the increased rate of diagnosis during pregnancy [2]. The reported prevalence of a SAA varies between 0.01 and 10.4% and since SAAs are often asymptomatic, the true prevalence is unknown [11].

Pathophysiology of SAAs in Pregnancy

The pathogenesis of SAAs is not well understood; however, the main theory behind the development of SAAs in pregnancy implicates increased circulating levels of the hormones estrogen, progesterone, and relaxin [5]. The increased cardiac output, blood volume, flow velocity, and relative portal hypertension of pregnancy all change the hemodynamics within the splenic artery. The increased flow velocity to the splenic artery is secondary to compression of the distal aorta and iliac artery by the gravid uterus. The increased pressure and flow leads to weakening of the arterial wall resulting in dilatation and formation of the aneurysm [12]. The portal hypertension of pregnancy has also implicated hormones like aldosterone and renin in causing arterial wall thinning [2]. Multiple other etiologies account for the development of Visceral Artery Aneurysms (VAAs) in adults. The most common etiologies including: atherosclerosis (32%), medial degeneration (24%), and abdominal trauma (24%) [6].

Pathomechanics of Rupture

During pregnancy, SAAs are more likely to rupture in the third trimester or puerperium, 2/3^{rds} of aneurysms rupture in third trimester followed by second trimester ruptures [2,3]. Risk factors for rupture include pregnancy, pancreatitis, portal hypertension, liver transplantation, rapid growth, and size >2 cm [4]. The size of the aneurysm is usually more than 2.5 cm at the time of rupture [2]. If a woman has an existing SAA, the risk of rupture during pregnancy is 20% to 50% [14]. SAA rupture can present suddenly or as a two-stage rupture, the latter representing approximately 25% of the cases. In the two-stage rupture, initially the rupture is contained within the lesser sac by omentum or blood clots that block the Foramen of Winslow; this is followed by free rupture into the greater sac. The clinical presentation of the two-stage rupture involves sudden abdominal pain followed by a period of stability with subsequent sudden collapse [2,5]. Hemodynamic instability in pregnancy is more difficult to recognize due to the woman's increased physiologic reserve, which includes an increase in circulating volume. Signs of hypovolemia appear when 35% or more of the total circulating volume is lost which is compensated by vasoconstriction and decreased blood flow to select end organs including the placenta. Clinically, this can be demonstrated by fetal distress and changes in fetal monitoring [11].

Diagnostic Features

The presentation of SAAs results from the rupture of the aneurysm. Patients often present with sharp abdominal pain in the epigastrium or in the left hypochondrial area with associated pain in the tip of the left shoulder (Kehr's sign). This can be associated with nausea, vomiting, and sudden collapse [2]. While SAAs are generally asymptomatic pre-rupture, pregnant women who are experiencing pain in left upper quadrant should be screened for a possible SAA [3]. Placental abruption is one of the most commonly made misdiagnoses; however, uterine rupture, heterotopic pregnancy, various gastrointestinal pathologies, and rupture of other arterial aneurysms all share similar

clinical presentations and symptoms [2,4,12]. Working up pregnant women can be challenging, considering radiation exposure to the mother and fetus is not recommended. Ultrasonography can rapidly evaluate a patient for an acute abdominal pathology and MRI is also available for stable patients [2,4]. When SAAs are suspected; angiography is the gold standard for diagnosis. CT and MRI are useful for 3D evaluation of aneurysms, and even X-rays can detect splenic artery aneurysms with calcifications. In pregnancy, however, ultrasound is the preferred diagnostic modality [2,5].

Management

In cases of symptomatic SAA, immediate treatment is warranted. Treatment options include: open, laparoscopic, or embolization of the aneurysm. However, in cases of rupture, immediate resuscitation and cessation of bleeding are of first and foremost importance [2]. Appropriate treatment of SAAs depends on the location, the age of the patient, the operative risks, and the clinical status. For pregnant women with an SAA greater than or equal to 2 cm in diameter, minimally invasive surgical intervention is the recommended modality of treatment. However, it has also been reported that even in SAAs less than or equal to 2 cm, treatment should be done, as the diameter does not reflect the probability of rupture [13]. Minimally invasive surgical techniques for treating SAAs consist of splenic artery ligation, resection of splenic artery, and splenectomy [2,3]. Proximal third SAAs are treated with simple ligation. Middle third SAAs are treated with proximal and distal ligation, and the short gastric arteries are usually enough circulation to preserve the spleen. Distal SAAs require resection and splenectomy with possible distal pancreatectomy [2,5]. Ruptured splenic artery aneurysms are treated with resuscitation followed by laparotomy, resection of aneurysm, and splenectomy. Neonatal and critical care support and transport to a referral center with these capabilities should be arranged [3,5]. The mortality rate of non-emergent treatment of SAA sis 0.5% to 1.3%. The mortality rate of emergently managed SAAs in pregnant women is 75% [5]. Postoperatively, asplenic patients need made aware of potentially life-threatening infectious complications and they must also receive vaccinations against *pneumococci*, *haemophilus influenzae* type b, *meningococci*, and the influenza virus [11].

Conclusion

Although splenic artery aneurysms are a rare entity, the risk of aneurysmal rupture is increased during pregnancy with a consequential high maternal and fetal mortality rate associated with rupture of SAA during pregnancy. Elective surgery is necessary and should be performed when possible pre-rupture to ensure optimal maternal and fetal outcomes. In this case, we performed a laparoscopic splenectomy after a cesarean section in the setting of a non-ruptured aneurysm with great outcomes. It is important to maintain awareness of this condition due to the high maternal and fetal mortality rate post-rupture and to maintain awareness of this condition in pregnancy to avoid misdiagnosis.

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