CASE REPORT

Perforated second trimester appendicitis with abdominal compartment syndrome managed with negative pressure wound therapy and open abdomen

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Abstract
Abdominal compartment syndrome (ACS) is a known complication of laparotomy; however, the literature is lacking in regards to treatment of this entity in pregnant patients. We present a case of acute perforated appendicitis in a second trimester primagravida, complicated by gangrenous necrosis of the contiguous bowel with subsequent development of ACS and intra-abdominal sepsis. This was treated with a novel approach, using non-commercial negative pressure wound therapy and open abdomen technique. Gestational integrity was preserved and the patient went on to experience a normal spontaneous vaginal delivery. At 5 years post-delivery the patient has had no surgical complications and her baby has met all developmental milestones.

INTRODUCTION
Acute appendicitis is the most common general surgical condition encountered during pregnancy [1]. Maternal morbidity with acute perforated appendicitis approximates less than 2% [2]. Fetal mortality associated with perforated acute appendicitis ranges from 20% to 35% and premature delivery from 15% to 45% [1]. Spillage of intestinal contents can lead to complicated intra-abdominal sepsis (IAS) with an increased risk of maternal and fetal mortality and preterm labor and delivery [1, 3]. We present a case of acute perforated appendicitis in a primagravida complicated by subsequent IAS and abdominal compartment syndrome treated in novel fashion.

CASE REPORT
A 30-year-old G1P0 Hispanic female presented at 15 weeks gestation with primary complaint of 5-day history of acute, progressive right lower and right upper quadrant abdominal pain associated with dysuria, nausea and vomiting. Emesis progressed to complete oral intolerance for the 12 h preceding presentation. Emergency department presentation 3 days prior reported analogous symptoms diagnosed as acute 'hyperemesis gravidarum'. Obstetrical ultrasound reported 'single living intrauterine pregnancy with an estimated gestation age of 13 weeks, 6 ± 8 days'. Fetal heart tones (FHTs) measured 160 bpm. No mention of appendiceal imaging was relayed. The
GRANUFOAM of formed on post-operative day 12. The patient progressed to a Delayed primary closure of the laparotomy incision was performed.

Laparoscopic abdominal access was achieved and revealed massive bowel distention and purulent ascites. Conversion from laparoscopy to open laparotomy followed. An abscess was discovered that had enveloped the ileocecum. Perforation of the appendiceal base with extension into the cecum was readily apparent and associated with cecal necrosis. Ileocecectomy was performed in the standard fashion. The abdomen was irrigated and attempted fascial closure was abandoned due to significant abdominal wall tension secondary to pronounced bowel edema. ACS was diagnosed and the abdomen was left open. Temporary closure was performed using a sterile radiologic cassette cover perforated with a #10 blade scalp, which was draped over the viscera. A saline-dampened surgical towel was placed over the cassette cover followed by two 10-French flat surgical drains. These drains were then covered by another saline-dampened towel. Closure of the abdominal domain was afforded with use of ‘loban™’ drape. The patient was then intubated and transferred to the intensive care unit (ICU).

Intravenous antibiotics and resuscitation fluids were provided. Consultations were obtained with infectious disease and the patient’s obstetrician. Daily FHTs were determined at bedside by the obstetrician. Negative pressure therapy was maintained at 120–130 mmHg via wall suction. Peritoneal toilet with inspection of the ileocolic anastomosis was performed on post-operative day 4, notable for complete integrity. No evidence of bowel necrosis was appreciated. Significant bowel edema was noted, again preventing fascial closure. Temporary abdominal closure was achieved with dressings analogous to those mentioned previously. Fascial closure was achieved on post-operative day 6. Skin closure was deferred using a Wound VAC™ with GRANUFOAM™ and the patient was extubated in the ICU. Delayed primary closure of the laparotomy incision was performed on post-operative day 12. The patient progressed to a regular diet without complications. Pathology returned a diagnosis of ‘acute ruptured appendixitis with associated abscess formation and acute serositis’. She was discharged home on post-operative day 15.

Tocolysis was not indicated and therefore deferred throughout her admission. Eventual normal spontaneous vaginal delivery was achieved. The mother reports no incisional hernia development at 5 years following surgery. She also reports her daughter has obtained all developmental milestones and has developed only common childhood illnesses.

**DISCUSSION**

Treatment of gestational ACS is notably absent in the literature. Scientific descriptions of the incidence, mortality and pathophysiologic changes of gestational ACS remain unknown. Published literature abounds with studies relating the characteristics, pathophysiology, treatment, epidemiology, risk factors and outcomes for non-gestational ACS. This case report uniquely describes the first use of temporary abdominal closure for treatment of ACS secondary to acute ruptured gestational appendicitis with IAS in a second trimester nullipara.

Temporary abdominal closure and negative pressure wound therapy (NPWT) have each been described in pregnancy [4, 5]. Staszewicz et al. describe the use of NPWT for interval intestinal assessment in a second trimester patient with discontinuous necrosis of the small intestine [5]. This patient’s treatment involved staged segmental resections of necrotic bowel with re-establishment of continuity facilitated by an open abdomen and NPWT. IAS or intra-abdominal hypertension did not complicate this case. Shapiro et al. also report the use of NPWT in the management of dehiscence of a midline upper abdominal laparotomy following adhesiolysis of a constricting bank for a second trimester intestinal obstruction with 2 cm segmental small intestinal infarction [4]. Dehiscence following wound infection is described in this case on post-operative day 14 during incision and drainage of a wound abscess. Two days of post-operative wet-to-dry dressing changes yielded to NPWT, which was successfully employed for 23 days directly over the gravid uterus [4]. The author reports that fascial closure was not achieved with granulation tissue with subsequent epithelialization occurring directly over the gravid uterus.

In this case report, NPWT was used to facilitate treatment of acute perforated second trimester gestational appendicitis with IAS complicated by ACS. We employed a temporary abdominal wound closure system modified from Barker et al. [6]. Treatment of ACS and IAS with NPWT for approximately one week provided excellent results with eventual fascial closure and preservation of intra-abdominal domain without precipitating preterm contractions. Prophylactic tocolysis was deferred in this case because efficacy has not been demonstrated [2]. Previous studies involving the use of negative pressure therapy for open gestational abdomens that utilized commercially prepared devices were not used in the setting of IAS and did not require over 48 h of mechanical ventilation. This report demonstrates that IAS with ACS in the second trimester can be successfully treated utilizing a non-commercial temporary abdominal closure device and modern sepsis treatment, while preserving gestational integrity.

**CONFLICT OF INTEREST STATEMENT**

None declared.

**REFERENCES**

1. McGory ML, Zingmond DS, Tillou A, Hiatt JR, Ko CY, Cryer HM. Negative appendectomy in pregnant women is associated with a substantial risk of fetal loss. J Am Coll Surg 2007;205:534–40.
2. Pastore PA, Loomis DM, Sauret J. Appendicisitis in pregnancy. /J Am Board Fam Med 2006;19:621–6.
3. Babaknia A, Hossein P, Woodruff JD. Appendicitis during pregnancy. Obstet Gynecol 1977;50:40–4.
4. Shapiro SB, Mumme DE. Use of negative pressure wound therapy in the management of wound dehiscence in a pregnant patient. Wounds 2008;20:46–8.
5. Staszewicz W, Christodoulou M, Marty F, Bettschart V. Damage control surgery by keeping the abdomen open during pregnancy: a favorable outcome case report. World J Emerg Surg 2009;4:33.
6. Barker DE, Kaufman HJ, Smith LA, Ciraulo DL, Richart CL, Burns RP. Vacuum pack technique abdominal closure: a 7-year experience with 112 patients. J Trauma 2000;48:201–6.