INVITED ARTICLE

Parturient with Acute Abdomen

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Abstract

Management of a parturient with an acute abdomen presents unique challenges. We aim to review the common obstetric and nonobstetric causes for acute abdomen in pregnancy, approach to diagnosis, the role of imaging, and management including the scope and timing of operative intervention.

Keywords: Acute abdomen, Delays, Fetomaternal outcome, ICU, Obstetric, Pregnancy.

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Management of a parturient presenting with an acute abdomen is challenging. An acute abdomen is defined as "any serious acute intra-abdominal condition attended by pain, tenderness, and muscular rigidity, and for which emergency surgery must be considered." The causes for abdominal symptoms in pregnancy could be many. Obstetric and nonobstetric conditions may coexist, making it a diagnostic challenge. Clinical presentation of an acute abdomen may mimic some of the symptoms associated with physiological changes in pregnancy, making the clinical picture a convoluted one. The clinician's hesitancy to use radiological imaging in pregnancy due to possible fetal effects further adds to the diagnostic conundrum. The following article aims to review the common obstetric and nonobstetric causes for acute abdomen in pregnancy, approach to diagnosis, and management including the scope and timing of operative intervention.

Changes in Pregnancy Affecting the Clinical Diagnosis of an Acute Abdomen

The stomach is displaced upwards and toward the left by the gravid uterus during pregnancy. The altered anatomical position and elevated progestin levels during pregnancy relax the lower esophageal sphincter predisposing to reflux of acid contents. Gastrointestinal reflux is a common occurrence during pregnancy affecting about 30–50% of parturients.[1] Nausea and vomiting are common accompaniments of pregnancy, affecting about 80% of parturients. It is more common during the first trimester, though it may last till 12–16 weeks of gestation.[2] However, nausea and vomiting persisting beyond 20 weeks of gestation associated with abdominal pain, vaginal bleeding, or fever usually indicate a pathological state.

Gastric motility is not altered during pregnancy.[3] However, intestinal transit time is slowed during pregnancy due to elevated progestin and concurrently decreased motilin levels.[4] About 40% of women experience constipation in pregnancy. The mechanisms attributed are twofold: Decreased colonic motility due to compression by the gravid uterus and elevated aldosterone levels causing salt and water retention.[5]

The liver is pushed upwards and toward the right by the gravid uterus. Serum levels of alkaline phosphatase increase during pregnancy due to placental production, making it less reliable to detect biliary tree pathology. Serum levels of aspartate and alanine aminotransferase, bilirubin, and lactate dehydrogenase levels rise to the upper levels of normal during pregnancy.[6] Biliary stasis and increased cholesterol-rich bile secretion predispose to an increased risk of stone formation.[7]

The uterus becomes an intra-abdominal organ by 12 weeks of gestation. At 20 weeks, it can be felt at the level of the umbilicus and reaches the costal margin by 36 weeks. The enlarging gravid uterus tends to displace the abdominal viscera from their normal anatomical positions. Aortocaval compression occurs as early as 12–16 weeks of pregnancy, leading to lightheadedness, syncope, and hypotension. The symptoms usually resolve with left lateral positioning. Some amount of abdominal/pelvic discomfort is common during pregnancy due to stretching of the round ligament in the first trimester, uterine contractions, and fetal movement in late pregnancy. The gravid uterus often compresses the urinary tract leading to hydroureter and hydronephrosis.[8]

Altered anatomical relations make the clinical diagnosis of an abdominal emergency difficult in pregnancy. The classic clinical signs of guarding and rigidity are less pronounced due to a relaxed and stretched abdominal wall. The clinician should always keep the altered anatomy in mind while clinical examining such patients. The relevant changes affecting other organ systems are summarized in Tables 1A and B.

General Approach to Acute Abdomen in Pregnancy

The initial approach to a parturient presenting with an acute abdomen should focus on identifying life-threatening emergencies that would require urgent intervention. A detailed history and

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physical examination supplemented by appropriate imaging are sine qua non for an accurate diagnosis and management (Fig. 1). It is imperative to involve an obstetrician early in the management of such patients.

History

A detailed history should ideally be obtained at the time of admission with emphasis on:

- Gestational age
- Pain: Onset, duration, localization, aggravating, and relieving factors
- Associate symptoms, for example, nausea, vomiting, constipation, change in urinary frequency, burning micturition, etc.
- H/o fever may indicate infection, but could also be potentially noninfectious.
- Obstetric history: Pregnancy-related complications are more likely with bad obstetric history
- H/o vaginal bleeding: May indicate placental abruption, miscarriage, or ectopic pregnancy according to gestational age
- Fluid leak: Associated with premature rupture of membranes
- Rule out trauma

Physical Examination

The clinician must remember the distorted anatomy due to the gravid uterus pushing the abdominal viscera to either side of the midline. For example, the appendix is pushed upwards in the third

Table 1A: Anatomical and physiological changes in pregnancy

Cardiovascular	*Respiratory*	*Hematology*
• Flow murmur • Accentuated heart sounds • Left ventricular hypertrophy • Increase in heart rate (15–25%) • Increased cardiac output • Decrease in systemic vascular resistance • Aortocaval compression (16–18 weeks period of gestation)	• Increased thoracic diameters • Airway edema • Decreased functional residual capacity (20%) • Increased tidal volume and minute ventilation (45%) • Dyspnea • Decreased $PaCO_2$ (30 mm Hg)	• Increased plasma volume • Physiological anemia • Decreased plasma proteins • Enhanced clotting and fibrinolysis • Increased clotting factors • *Leukocytosis (increased polymorphonuclear neutrophils (PMN) cells)* • Impaired PMN function • Immune tolerance

Table 1B: Anatomical and physiological changes in pregnancy

Renal	*Endocrine*	*Miscellaneous*
• Increased glomerular filtration rate (50%) • Increased renal blood volume • Increased creatinine clearance • Increased urinary protein loss	• Thyroid gland enlargement • Increased T3 and T4, and decreased thyroid-stimulating hormone • Insulin resistance • Elevated plasma cortisol and cortisol-bonding globulin	• Back pain • Lumbar lordosis • Sleep disturbances • Elevated pain threshold

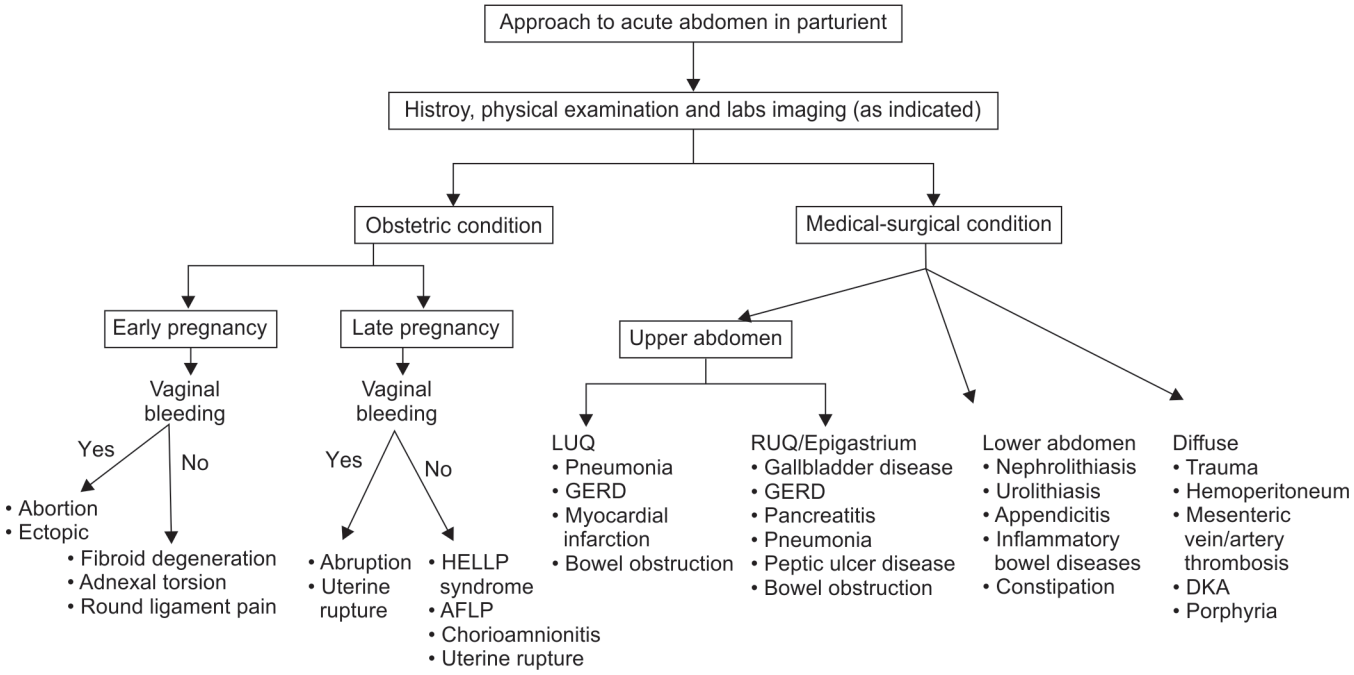

Fig. 1: Diagnostic approach to the acute abdomen in a parturient. DKA, diabetic ketoacidosis; GERD, gastroesophageal reflux disease; LUQ, left upper quadrant; RUQ, right upper quadrant

trimester of the pregnancy so that it lies closer to the gallbladder fossa.[9] Hence, any areas of localized tenderness must be interpreted in the proper clinical context taking into account the possible location of the underlying viscera.

Additionally, classic clinical findings of abdominal pathology like guarding and rigidity may be less prominent due to a relaxed and stretched abdominal wall being lifted off the parietal peritoneum by the pregnant uterus.[10]

An obstetrician should perform an abdominal examination concurrently to assess for

- Fetal heart rate: To look for any evidence of fetal compromise that might indicate the need to expedite delivery. A non-reassuring fetal heart rate may be an indicator of an obstetric cause for acute abdomen.
- Uterus: Size, tone tenderness, and contraction frequency
- Patency of fetal membranes
- Cervical dilatation and effacement

Laboratory Tests

Laboratory tests should be interpreted taking into account the physiological alterations in pregnancy. Some amount of leukocytosis is common during late pregnancy and labor with white counts ranging from 8000–16000/mL. Blood and urine cultures should be performed when there is a clinical suspicion of infection.

Coagulation studies along with group and cross-matching should be performed when a patient presents with a vaginal bleed or an emergent surgery is anticipated.

Role of Imaging

Imaging in pregnancy is initially limited to ultrasound scans, due to concerns regarding the fetal risk of exposure to ionizing radiation. However, there is evidence to suggest that some of the concerns regarding teratogenicity and ionizing radiation are exaggerated.[11] Concerns with fetal well-being should not delay the performance of appropriate radiological scans, as the risks of a delayed diagnosis can have a far greater adverse effect on both the mother and fetus *in utero*.

Ultrasound

Ultrasound is usually the preferred initial investigation for the evaluation of abdominal pathologies due to its portability, lack of fetal radiation exposure, and optimal visualization of intra-abdominal structures. In addition, it is used by the obstetrician to assess fetal viability and well-being and to rule out obstetric causes of acute abdomen. However, visualization of pancreas and bowel pathologies might be limited using ultrasonography (USG) necessitating the need for other modalities.

Radiography

The harmful effects of ionizing radiation in pregnancy are often overestimated. The maximum fetal risk is during the period of organogenesis (2–8 weeks of gestation). An exposure of more than 0.2 Gy can induce fetal growth anomalies during 2–8 weeks, while mental retardation can occur if the exposure is more than 0.5 and 0.25 Gy during 8–12 and 12–25 weeks period of gestation, respectively. On the contrary, the estimated fetal absorption for chest and abdominal radiography is less than 0.01 and 4.2 mGy, which is far below the allowable safe limit of exposure.[12] Even multiple diagnostic procedures are unlikely to be associated with any short- or long-term adverse effect on the fetus as long as the cumulative absorbed dose of radiation is less than 0.05 Gy. However, the use of shields and nonionizing radiographic modalities can further limit harmful radiation exposure.

Computed tomography (CT) is the recommended modality for trauma and suspected pulmonary embolism even in parturients as benefits easily outweigh the risks associated with exposure.[13] Oral iodinated contrast agents are class B drugs, as per the United States Food and Drug Administration (FDA) with no proven fetal teratogenicity, and should be used as deemed necessary for enhanced visualization.

Magnetic Resonance Imaging

Noncontrast magnetic resonance imaging (MRI) is devoid of radiation hazards and is increasingly being used when ultrasound is inconclusive. MRI has shown superior visualization of the appendix compared to USG in pregnancy and is, therefore, recommended as the first-line imaging technique for acute appendicitis.[14] MRI with a field strength of 1.5 Tesla is considered safe in pregnancy. Gadolinium iv is a category C drug as per the US FDA and should be avoided in pregnancy due to risks of transplacental transfer and unknown fetal effects.

Review of Causes of Acute Abdomen in Pregnancy

The differential diagnosis of an acute abdomen presenting during pregnancy can be broadly divided into (Tables 2A and B):

- Nonobstetric conditions
- Obstetric conditions
- Pregnancy-associated conditions: Conditions aggravated in pregnancy

Common Nonobstetric Causes of Acute Abdomen in Pregnancy

Acute Appendicitis

Acute appendicitis is the most common nonobstetric surgical emergency affecting about 1 in 1,500 pregnancies.[15] It is more common during the second trimester, though it can present during any of the trimesters. Acute appendicitis presents with pain localized to the umbilicus or around McBurney's point, along with nausea, vomiting, and fever. Leukocytosis is common. Clinical signs, such as guarding, tenderness, and rebound tenderness, may be difficult to elicit due to anatomical and physiological changes as discussed previously. The appendix is pushed cephalad toward the right upper quadrant (RUQ) by the enlarged gravid uterus late in pregnancy, and localization of pain may migrate accordingly.

Graded compression USG is the first-line imaging modality in suspected acute appendicitis and has a reported sensitivity of 67–100% and specificity of 83.3–96% in various studies.[16] MRI offers better visualization of the appendix and has been suggested as the next imaging modality in cases of inconclusive USG.[14] The goal of imaging is twofold: To prevent any unnecessary delays in operative management and to decrease the negative appendicectomy rate.

The definitive treatment of appendicitis is surgical resection. Laparoscopy is the preferred approach and is increasingly being used for diagnosis as well. Delay in diagnosis or operative management increases the risk of perforation, abscess formation, and peritonitis, which adversely impacts maternal and fetal outcomes.[17]

Table 2A: Nonobstetric conditions presenting as acute abdomen in pregnancy

Gastrointestinal causes	*Genitourinary causes*	*Vascular causes*
• Acute appendicitis	• Ruptured ovarian cyst	• Superior mesenteric artery syndrome
• Acute pancreatitis	• Adnexal torsion	• Mesenteric venous thrombosis/infarction
• Peptic ulcer	• Ureteral calculi	• Ruptured visceral artery aneurysm
• Gastroenteritis	• Rupture of renal pelvis	• Splenic artery aneurysm
• Hepatitis	• Ureteral obstruction	
• Bowel obstruction/perforation	**Respiratory**	**Miscellaneous causes**
• Toxic megacolon	• Pneumonia	• Splenic rupture
• Herniation	• Pulmonary embolism	• *Abdominal trauma*
• Diverticulitis		• AIP
• Inflammatory bowel disease		• DKA
		• Sickle cell crisis

AIP, acute intermittent porphyria

Table 2B: Obstetric conditions presenting as acute abdomen in pregnancy

Early pregnancy	*Late pregnancy*	*Pregnancy-associated conditions*
• Ruptured ectopic pregnancy	• Red degeneration of fibroid	• Acute pyelonephritis
• Septic abortion	• Abruptio placenta	• Acute cystitis
• Urinary retention	• Placenta percreta	• Acute cholecystitis
	• HELLP syndrome	• AFLP
	• Hepatic rupture	• Rupture of rectus
	• Uterine rupture	• Uterine torsion
	• Chorioamnionitis	

AFLP, acute fatty liver of pregnancy

Gallbladder Diseases

Pregnancy predisposes to the formation of gallstones due to biliary stasis and cholesterol-rich bile secretion. Gallstone diseases in pregnancy present similarly as in nonpregnant adults. RUQ pain is characteristic, associated with nausea and anorexia that is typically aggravated after eating a fat-rich meal. The pain is described as deep and gnawing with radiation to the back. Murphy's sign can be elicited on deep palpation. Laboratory anomalies in gall stone diseases, such as leukocytosis and elevated alkaline phosphatase levels, are often a normal finding in pregnancy and, therefore, less useful. Ultrasound is diagnostic.

Asymptomatic gallstones are present in 3–4% of pregnant women. In the case of symptomatic gallstones, the role of nonoperative management versus surgery is a matter of debate. Conservative treatment primarily consists of adequate hydration, intravenous antibiotics, and analgesics for pain control while allowing the inflammation to subside with bowel rest. Failure of conservative therapy or frequent relapses will mandate surgery. A laparoscopic approach is found to be safe in parturients.[18] Operative management has been associated with less likelihood of fetal loss and preterm birth compared to conservative treatment in some series.[19]

Bowel Obstruction

The likelihood of bowel obstruction during pregnancy increases with the advancement of gestational age. Adhesions from previous surgery and volvulus are the most common causes for bowel obstruction with estimated fetal loss as high as 17%.[20] The parturient presents with symptoms of nausea, frequent bouts of vomiting, abdominal pain, and obstipation. Abdominal distension can be falsely attributed to the gravid uterus. Hyperperistalsis is a common accompaniment of pregnancy. The absence of bowel sounds is an ominous sign indicating bowel strangulation. An upright abdominal X-ray or low-dose CT should be performed based on a riskbenefit assessment given its high sensitivity in diagnosing bowel obstruction.[14] MRI has also been used as a safer alternative to locate the site of obstruction.

An initial trial of operative management includes nasogastric suction, bowel rest adequate hydration, and antibiotics. However, cases with failure of nonoperative management should proceed promptly to surgery given risks of maternal harm and fetal loss with a delayed decision-making. An open exploratory laparotomy with resection of the nonviable segment and decompression of the bowel is the favored approach in such cases.

Acute Pancreatitis

Most cases of acute pancreatitis in pregnancy are related to gall stone diseases. Other causes such as ethanol use, hypertriglyceridemia, viral infections, and trauma are relatively rare. Patients present classically with deep boring epigastric pain radiating to the back, relieved by leaning forward accompanied by feelings of nausea, vomiting, and anorexia. Low-grade fever and leukocytosis are present as part of systemic inflammatory response.

Characteristic lab anomalies include elevated serum amylase and lipase levels. USG of the upper abdomen can reveal a bulky pancreas, etiology of pancreatitis such as gall stone or common bile duct stone. It can be used to delineate complications such as pancreatic pseudocyst formation. MRI can be performed to gain additional information. Management is primarily supportive with adequate hydration and pain management, bowel rest, correction

of electrolyte abnormalities, and gradual resumption of enteral nutrition. Operative management is reserved for cases of gall stone pancreatitis.[21]

Nephrolithiasis/Urolithiasis

While relatively rare as a cause for acute abdomen, parturients usually present with flank pain radiating to the groin, dysuria, fever, and costovertebral angle tenderness. Hematuria (microscopic/gross) and pyuria may be present on urinary microscopy. Ultrasound is reliable for detecting nephrolithiasis, but visualization of ureters is difficult due to the gravid uterus. A low-dose CT pyelogram or MRI should be performed if clinically indicated. Most stones pass spontaneously with hydration. Minimally invasive procedures should be reserved for cases of ongoing obstruction, infection, and failed conservative treatment.[22] Extracorporeal shock wave lithotripsy is avoided in pregnancy.

Gastroesophageal Reflux

Reflux symptoms like heartburn, abdominal pain, and regurgitation are extremely common in parturients due to physiological changes in pregnancy. Most are managed with diet and lifestyle modification, and pharmacological therapy includes antacids and sucralfate as a first-line agent, and H2 receptor antagonists and proton pump inhibitors in refractory cases.[23] Endoscopy if indicated should be performed preferably in the second trimester.[24]

Trauma

Trauma complicates about 1 in 12 pregnancies and can lead to adverse maternal and fetal outcomes.[25] Maternal well-being and stabilization should take precedence in trauma management in parturients. Imaging, including CT polytrauma, should be performed as indicated without worrying about radiation hazards. The presence of an obstetrician is essential to rule out complications of trauma such as placental abruption, preterm labor, and premature membrane rupture. The Kleihauer–Betke test should be performed to rule out fetomaternal hemorrhage.

Common Obstetric Causes of Acute Abdomen in Pregnancy

Ectopic Pregnancy

Ruptured ectopic pregnancy is a life-threatening cause of acute abdomen with maternal mortality as high as 6%.[26] The fallopian tubes are the most common site of implantation. Any pregnant/sexually active woman in the reproductive age-group presenting with lower abdominal pain and abnormal uterine bleeding should undergo a prompt ultrasound examination to rule out ectopic pregnancy. Serum human chorionic gonadotropin levels are elevated. Hemodynamically stable patients with unruptured ectopic can be managed medically with methotrexate and judicious follow-up. Ruptured ectopic pregnancies present with hemodynamic (HD) instability and will require emergent surgery along with concurrent resuscitation.[27]

Placental Abruption

Placental abruption is the early separation of a normally situated placenta. It presents with abdominal pain and vaginal bleeding, though bleeding can be concealed in some cases. Uterine tenderness, non-reassuring fetal heart rate, and uterus size that exceeds the gestational age are characteristics. Diagnosis is based on the clinical findings. USG may show a subchorionic or retroplacental clot. In cases of fetal compromise, expeditious delivery is necessary.[28]

Uterine Rupture

Uterine rupture is an ominous condition with high maternal and perinatal mortality.[29] Prior C-section or surgeries of the uterus are a definite risk factor. A scarred uterus is more likely to rupture during labor. The parturient complaints of severe abdominal pain, though pain may be referred to the shoulder from diaphragmatic irritation from hemoperitoneum. The diagnosis is clinically based on loss of station of presenting part, non-reassuring fetal status, and palpation of fetal parts per abdomen. USG may aid in the diagnosis. The parturient needs to be rushed to the operating room for exploratory laparotomy along with concomitant resuscitation. Hysterectomy may be needed in some cases.[30]

HELLP Syndrome

The syndrome of hemolysis (microangiopathic hemolytic anemia), elevated liver enzymes, and low platelet (HELLP) count is classically seen in preeclamptic women. Abdominal pain located in the epigastrium or RUQ results from subcapsular or periportal hematoma and stretching of the Glisson's capsule. Diagnosis is clinical and based on the Tennessee criteria.[31] MRI can be used to detect a hematoma. Hepatic rupture can be catastrophic. Parturients with HELLP syndrome will need termination of pregnancy. Associated coagulopathy needs to be corrected, and steroids are administered for fetal lung maturity.

Adnexal Torsion

Parturients comprise about 20% of cases of adnexal torsion and are more likely to occur in early pregnancy. The presence of a preexisting adnexal mass predisposes to torsion. The patient presents with severe colicky lower abdominal/pelvic pain associated with nausea, vomiting, and occasionally a low-grade fever. USG might document absent blood flow in the affected ovary. The treatment is surgical. Preservation of the ovaries might be possible if the ovary is not necrotic; otherwise, salpingo-oophorectomy will be needed.[32]

Management Outline

The broad management outline of parturients presenting with acute abdomen depends on the clinical status of the patient and the underlying etiology (Fig. 2). Patients presenting with features of HD instability (hypotension, weak and thready pulse, raised lactates, cold, and clammy extremities) will need aggressive resuscitation and concurrent workup to determine the cause. Further management should be tailored to the underlying diagnosis.

Surgical Approach

The underlying diagnosis determines the surgical approach in parturients. Obstetric causes of the acute abdomen like ectopic pregnancy, placental abruption, and uterine rupture will usually need an emergent surgery and baby delivery in the same setting. Surgical causes of acute abdomen, such as acute appendicitis, may need an appendicectomy, and pregnancy can be continued based on fetal status and viability. Hence, the involvement of intensivists, anesthetists, obstetricians, and pediatrician is essential as part of a multidisciplinary care team to optimize decision-making and care for such patients.

Elective surgeries should preferably be avoided during pregnancy or timed during the second trimester. The risks of preterm labor, childbirth, and spontaneous loss are lowest if

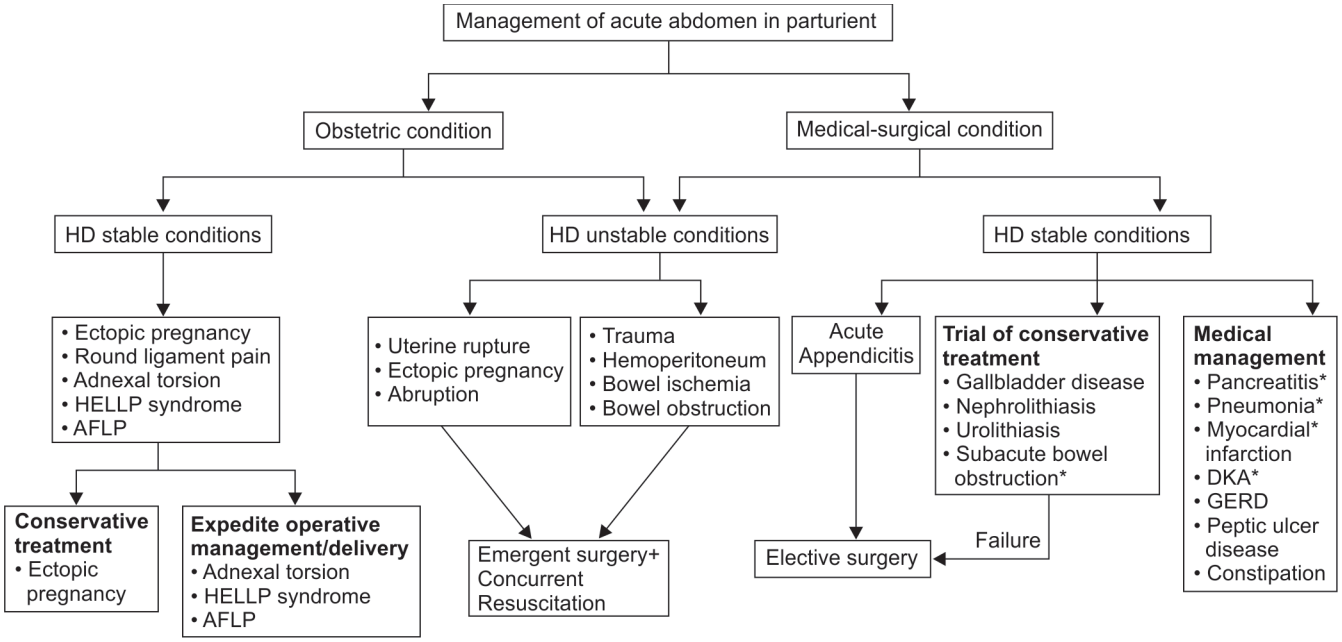

Fig. 2: Broad management outline of acute abdomen in a parturient. HD, hemodynamic; DKA, diabetic ketoacidosis; GERD, gastroesophageal reflux disease; AFLP, acute fatty liver of pregnancy. *Some of these conditions may present with hypotension and will need resuscitation

elective surgeries are performed during the second trimester of pregnancy.[33]

Laparoscopy in Pregnancy

The role of laparoscopy, as a diagnostic aid as well as to perform operative procedures in parturients, has evolved over the years. Concerns with laparoscopy in pregnancy include fetal acidosis from pneumoperitoneum and resultant hypercarbia, possible uterine perforation, fetal injury, and membrane rupture from inadvertent injury during insertion of trocar and needle. The benefits of a laparoscopic approach are manifold including less uterine manipulation, a lesser degree of postoperative pain, less ileus, shorter hospital stay, and faster return to normal activity. Laparoscopy has been increasingly used to perform a wide variety of surgical procedures, thereby establishing its safety in parturients.[34,35] The optimal time for laparoscopy is the second trimester, though it has been performed till 34 weeks of pregnancy.[36]

Summary

In summary, optimal management of a parturient with acute abdomen needs a multidisciplinary team approach. The anatomical and physiological changes in pregnancy should be appreciated while examining a parturient. While USG is the first-line imaging, the benefit of more extensive radiological workup should not be withheld as delays in diagnosis can have adverse maternal and perinatal outcomes. Maternal well-being should take precedence in cases of trauma. Elective surgeries can safely be performed in the second trimester of pregnancy, though maybe delayed till completion of pregnancy if considered prudent. A laparoscopic approach is being increasingly used even in parturients and is found to be safe in expert hands.

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