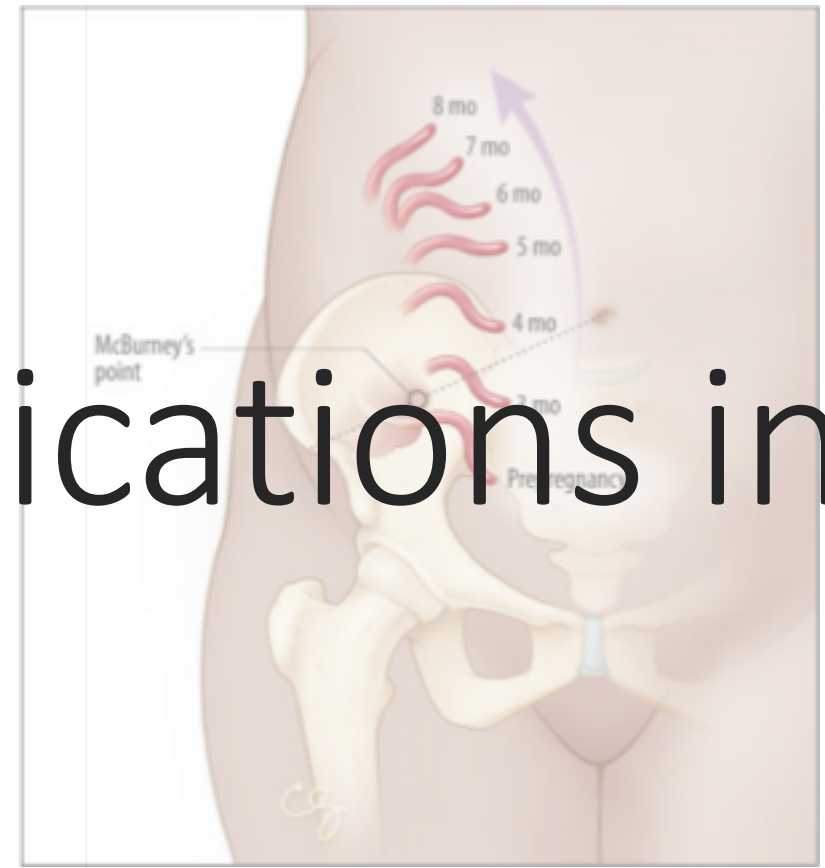
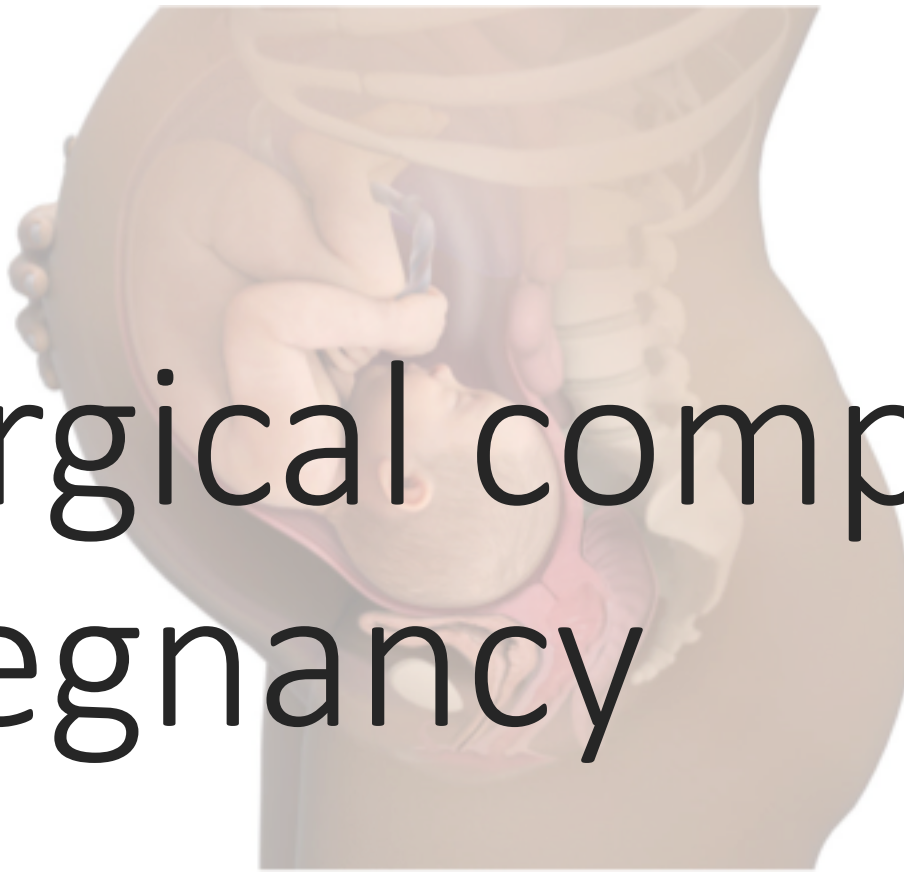


Surgical complications in Pregnancy



INA S. IRABON, MD, FPOGS, FPSRM, FPSGE

OBSTETRICS AND GYNECOLOGY

REPRODUCTIVE ENDOCRINOLOGY AND INFERTILITY

LAPAROSCOPY AND HYSTEROSCOPY

References:

1. Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24th edition; 2014; chapter 47
2. Cardiac Arrest in Pregnancy: A Scientific Statement From the American Heart Association; Circulation 2015

Outline

1. Physiologic changes in pregnancy
2. Surgical complications
3. CPR in pregnancy
4. Laparoscopy in pregnancy

Important Physiological Changes in Pregnancy

Important Physiological Changes in Pregnancy

Fetal development and maternal maintenance of pregnancy require multi-organ physiological adaptations:

1. Cardiac output: Inc. 30% to 50% → due to **increase stroke volume and increase maternal heart rate (15–20 bpm)**.
2. Systemic vascular resistance decrease due to **increase in several endogenous vasodilators (progesterone, estrogen, and nitric oxide)** → leading to a decrease in mean arterial pressure (nadir in the second trimester.)
3. The enlarging uterus can produce **increased afterload** through compression of the **aorta** and decreased cardiac return through **compression of the inferior vena cava**, starting at ≈12 to 14 weeks of gestational age.
 - *As a result, the supine position, which is most favorable for resuscitation, can lead to hypotension.*

Important Physiological Changes in Pregnancy

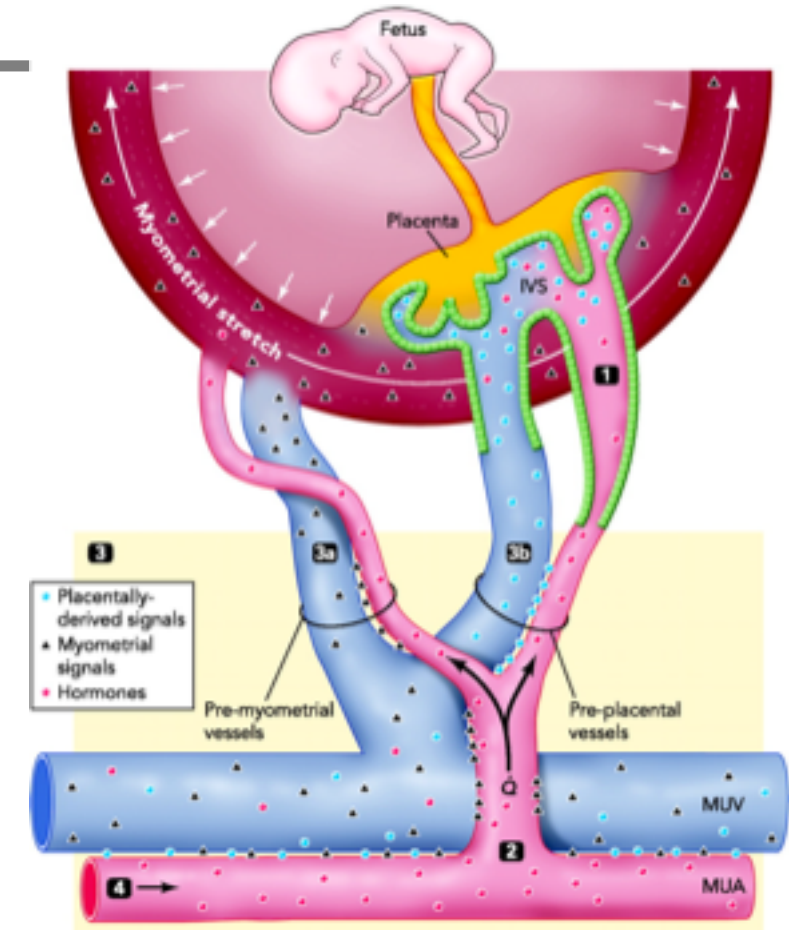
A magnetic resonance imaging study comparing the maternal hemodynamics in the **left lateral position** with those in the supine position was performed:

findings:

- At 20 AOG: significant increase in ejection fraction of 8% and stroke volume of 27% in the left lateral position.
- At 32 weeks: significant increase in ejection fraction of 11%, in end-diastolic volume of 21%, in stroke volume of 35%, and in cardiac output of 24% in the left lateral position

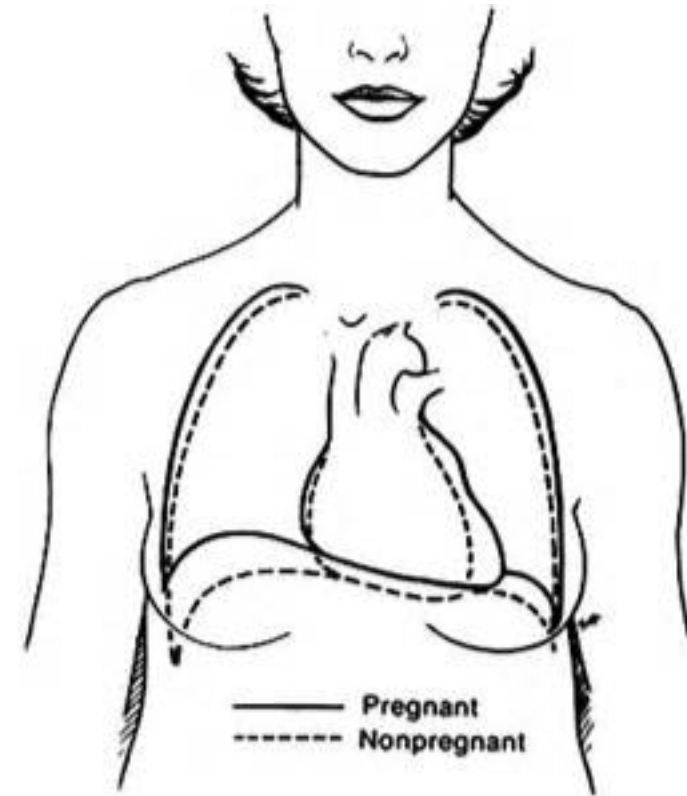
Important Physiological Changes in Pregnancy

- **Uteroplacental blood flow** increases from 50 to close to 1000 mL/min during pregnancy, receiving up to a maximum of 20% of maternal cardiac output at term.
- **Expanded intravascular volume and a decrease in uterine vascular resistance** facilitate sufficient uterine placental blood.
- **Uterine vascular reactivity** is altered, characterized by reduced tone, enhanced vasodilation, and blunted vasoconstriction.



Important Physiological Changes in Pregnancy

- **Functional residual capacity** decreases by 10% to 25% during pregnancy as the uterus enlarges and elevates the diaphragm.
- **Increased ventilation** (ie, an increase in tidal volume and minute ventilation) occurs, beginning in the first trimester, reaching a level 20% to 40% above baseline by term → mediated by the **elevated serum progesterone levels**.
 - → This produces a **mild respiratory alkalosis** with compensatory renal excretion of bicarbonate, resulting in an arterial carbon dioxide pressure of ≈ 28 to 32 mmHg (3.7 – 4.3 kPa) and a plasma bicarbonate level of 18 to 21 mEq/L.

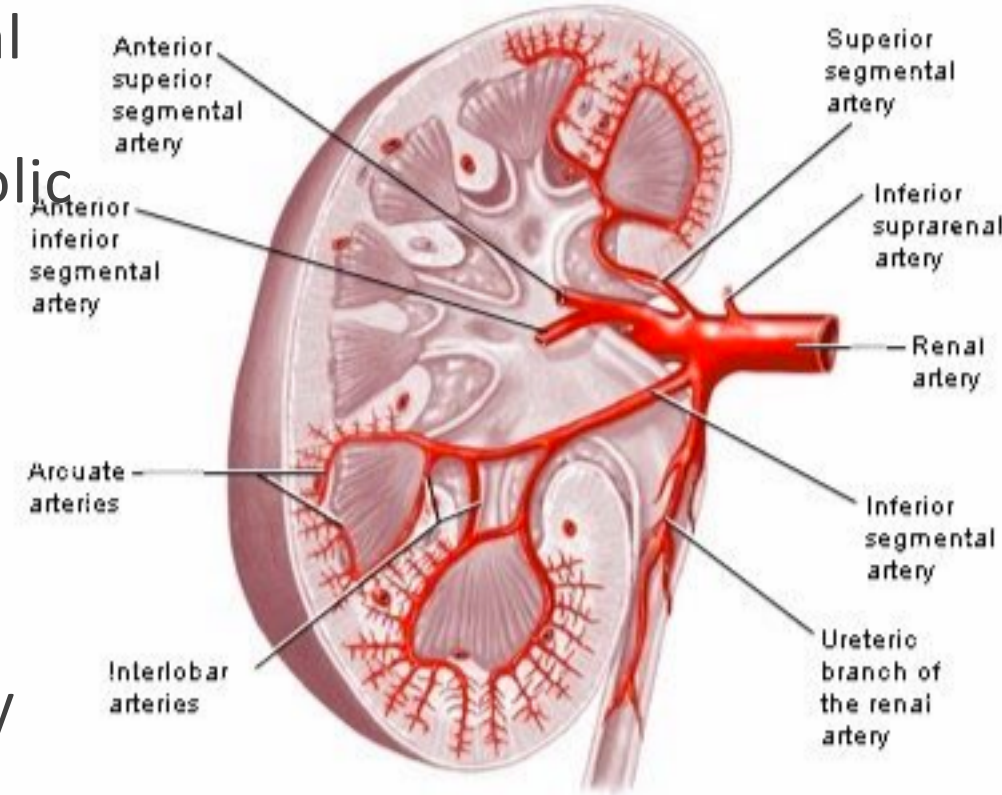


Important Physiological Changes in Pregnancy

- **Oxygen consumption** increases because of the demands of the fetus and maternal metabolic processes
- The reduced functional residual capacity reservoir and increased consumption of oxygen → rapid development of hypoxemia in response to hypoventilation or apnea in the pregnant woman.
- Upper airway edema and friability occur as a result of hormonal effects and may reduce visualization during laryngoscopy and increase the risk of bleeding.

Important Physiological Changes in Pregnancy

- Glomerular hyperfiltration and increased renal blood flow by 40% to accommodate the maternal role of fetal detoxification of metabolic byproducts and maintenance of maternal osmoregulation in the face of increased circulatory intravascular volume.
- Altered tubular function prevents wasting of glucose, amino acids, and proteins required by both maternal and fetal metabolisms.



Important Physiological Changes in Pregnancy

- Progesterone relaxes gastroesophageal sphincters and prolongs transit times throughout the intestinal tract during the second and third trimesters, predisposing the patient to aspiration of stomach contents.
- Drug metabolism is altered by several different mechanisms in pregnancy.
- Steroid-induced **acceleration of the hepatic P450 metabolism** and **increased renal clearance** will also lower circulating drug levels.

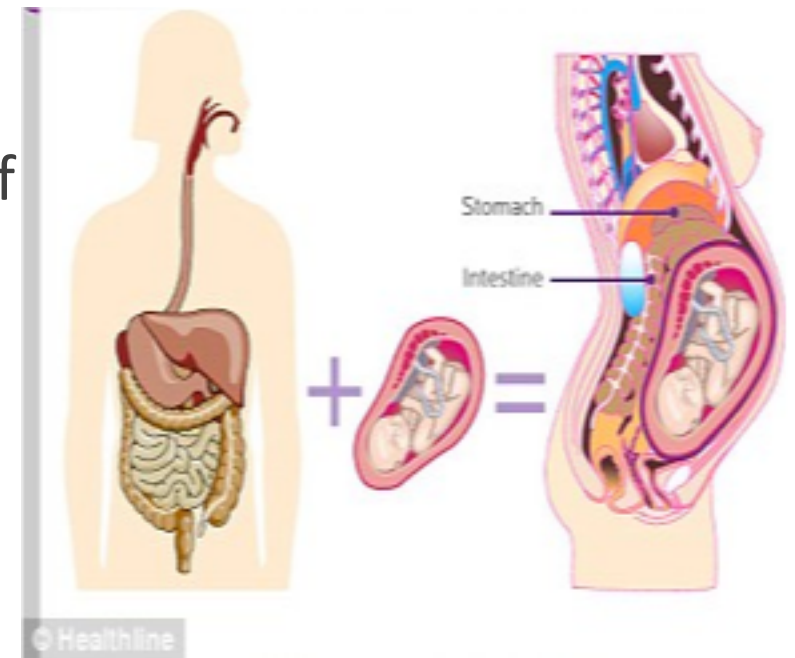


TABLE 47-3. Formulas for Deriving Various Cardiopulmonary Parameters

Mean arterial pressure (MAP) (mm Hg) = $[SBP + 2 (DBP)] \div 3$

Cardiac output (CO) (L/min) = heart rate \times stroke volume

Stroke volume (SV) (mL/beat) = CO/HR

Stroke index (SI) (mL/beat/m²) = stroke volume/BSA

Cardiac index (CI) (L/min/m²) = CO/BSA

Systemic vascular resistance (SVR) (dynes \times sec \times cm⁻⁵) =
 $[(MAP - CVP)/CO] \times 80$

Pulmonary vascular resistance (PVR) (dynes \times sec \times cm⁻⁵) =
 $[(MPAP - PCWP)/CO] \times 80$

BSA = body surface area (m²); CO = cardiac output (L/min);
CVP = central venous pressure (mm Hg); DBP = diastolic
blood pressure; HR = heart rate (beats/min); MAP = mean
systemic arterial pressure (mm Hg); MPAP = mean pulmo-
nary artery pressure (mm Hg); PCWP = pulmonary capillary
wedge pressure (mm Hg); SBP = systolic blood pressure.

Compute MAP of 150/70:

96.67 → 100

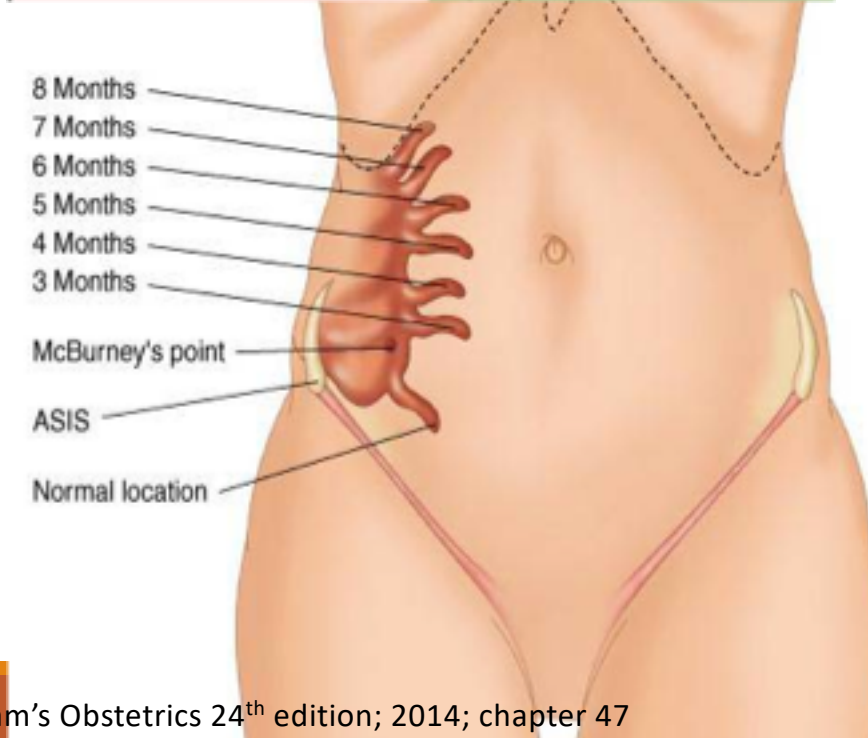
Surgical emergencies:

Appendicitis, Cholecystitis/Cholelithiasis, Trauma

Appendicitis

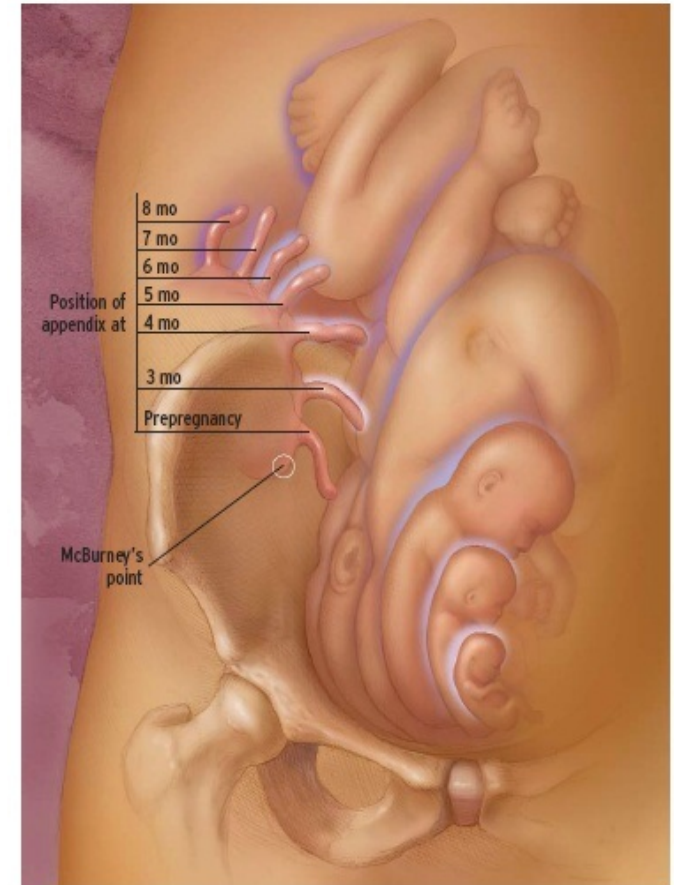
Appendicitis

- one of the most common indications for abdominal exploration during pregnancy.
- Pregnancy makes the diagnosis of appendicitis more difficult:
 1. Nausea and vomiting accompany normal pregnancy.
 2. some degree of leukocytosis accompanies normal pregnancy.
 3. As the uterus enlarges, the appendix commonly moves upward and outward from the right-lower quadrant



Appendicitis

- Pregnant women—especially those late in gestation—frequently **do not have clinical findings “typical” for appendicitis**
 - → *Thus, it commonly is confused with cholecystitis, preterm labor, pyelonephritis, renal colic, placental abruption, or uterine leiomyoma degeneration.*
- Most reports indicate increasing morbidity and mortality rates with increasing gestational age.
- And as the appendix is progressively deflected upward by the growing uterus, omental containment of infection becomes increasingly unlikely.
- appendiceal perforation is more common during later pregnancy.

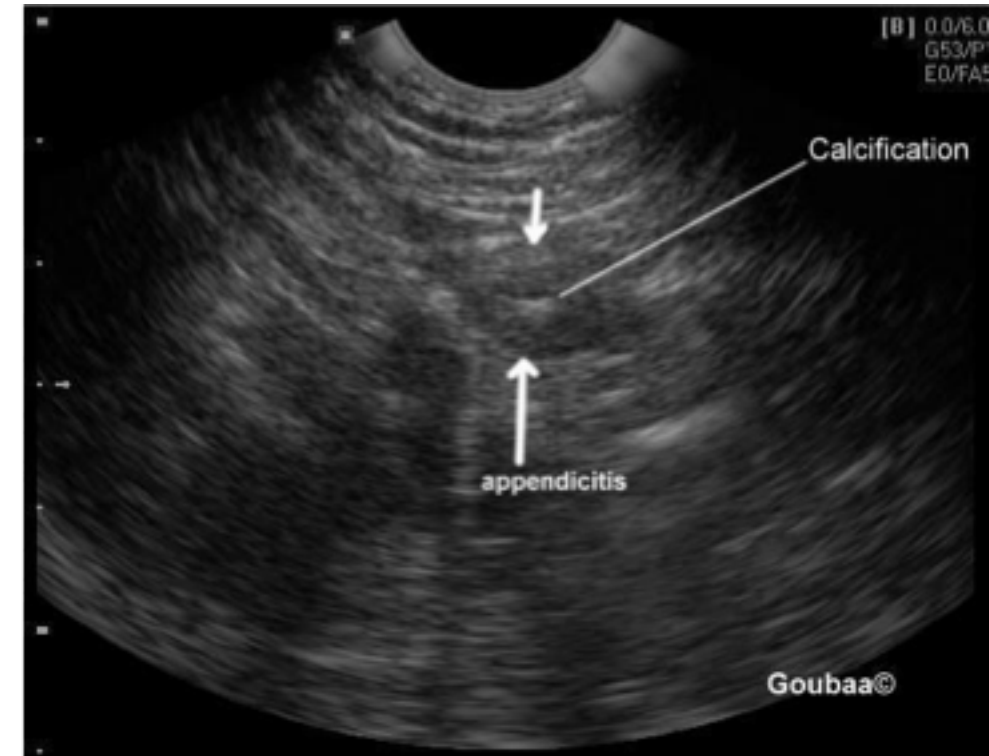


Appendicitis: Diagnosis

Persistent abdominal pain and tenderness are the most reproducible findings.

Right-lower quadrant pain is the most frequent, although pain migrates upward with appendiceal displacement

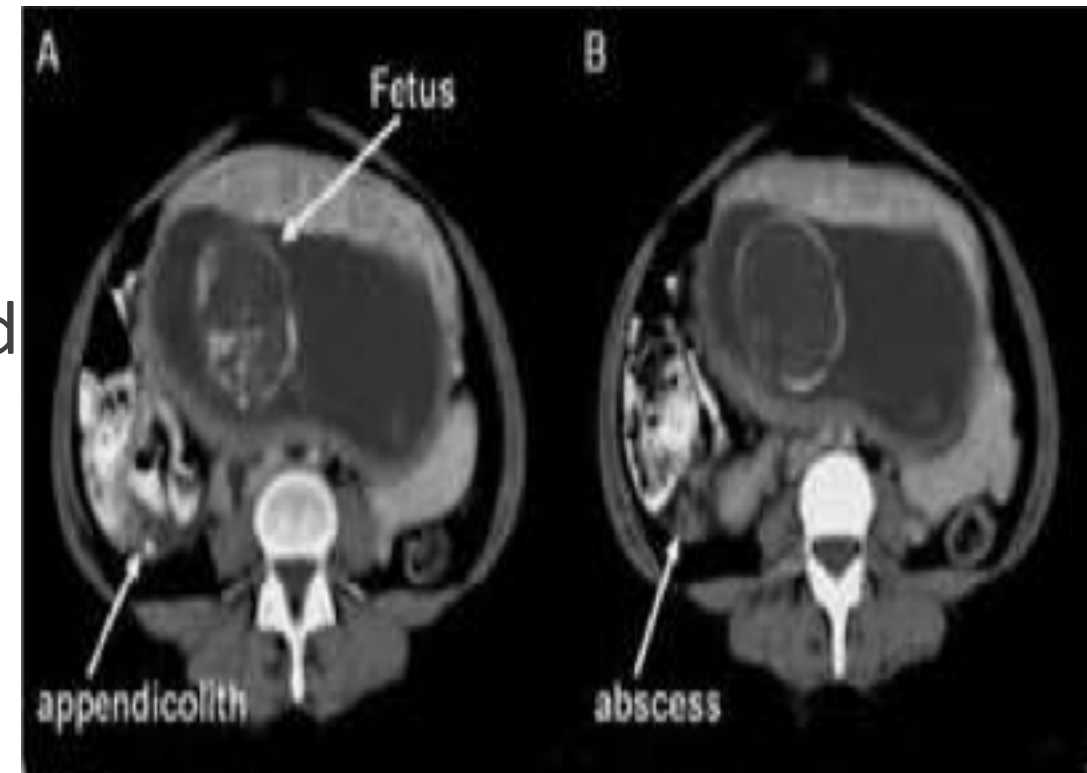
For evaluation, **sonographic abdominal imaging** is reasonable in suspected appendicitis, even if to exclude an obstetrical cause of right-lower quadrant pain



Appendicitis: Diagnosis

Appendiceal **MRI** or **computed tomography** is more sensitive and accurate than sonography to confirm suspected appendicitis

Using a decision-analysis model, CT and MR imaging were found to be cost effective



Appendicitis: Management

- When appendicitis is suspected, treatment is **prompt surgical exploration.**
- Although diagnostic errors may lead to removal of a normal appendix, *surgical evaluation is preferable to postponed intervention and generalized peritonitis.*
- In earlier reports, the diagnosis was verified in only 60 to 70 percent of pregnant women. However, as indicated above, with CT and MR imaging, these figures have improved
- Importantly, the accuracy of diagnosis is inversely proportional to gestational age

Appendicitis: Management

- **Laparoscopy** is almost always used to treat suspected appendicitis during the first two trimesters.
- Before exploration, intravenous antimicrobial therapy is begun, usually with a second-generation cephalosporin or third-generation penicillin.
- Unless there is gangrene, perforation, or a periappendiceal phlegmon, antimicrobial therapy can usually be discontinued after surgery.
- Without generalized peritonitis, the **prognosis is excellent**.

Appendicitis: Management

- Seldom is cesarean delivery indicated at the time of appendectomy.
- Uterine contractions are common, but some clinicians recommend tocolytic agents
 - *tocolytic use substantially increased the risk for pulmonary-permeability edema caused by sepsis syndrome*

Appendicitis Pregnancy Outcomes

- Appendicitis increases the likelihood of abortion or preterm labor, especially if there is peritonitis.
- Long-term complications are not common.
- The possible link between sepsis and neonatal neurological injury has not been verified
- appendicitis during pregnancy does not appear to be associated with subsequent infertility

Postpartum Acute Appendicitis

- Although new-onset appendicitis during the immediate puerperium is uncommon, in some women it is undiagnosed before delivery.
- Appendicitis in these women often stimulated labor and when the large uterus rapidly empties, walled-off infection may be disrupted to result in an acute surgical abdomen.
- In some cases, acute appendicitis or a periappendiceal abscess or phlegmon may be found at the time of cesarean delivery or puerperal tubal ligation
- It is important to remember that puerperal pelvic infections typically do not cause peritonitis.

Cholelithiasis and Cholecystitis

Cholelithiasis and Cholecystitis

Gallbladder Disease During Pregnancy

- The incidence of cholecystitis during pregnancy is reported to be approximately 1 in 1000.
- There is no doubt that pregnancy is “lithogenic.”
- After the first trimester, the gallbladder fasting volume as well as the residual volume after postprandial emptying are doubled.
- Incomplete emptying may result in retention of cholesterol crystals, a prerequisite for cholesterol gallstones.

Cholelithiasis and Cholecystitis

Gallbladder Disease During Pregnancy

- The incidence of biliary sludge—which can be a forerunner to gallstones—and gallstones in pregnancy are 31 and 2 percent, respectively.
- Postpartum, there is frequently regression of sludge, and occasionally gallstones will resorb.
- Still, after delivery, hospitalization for gallbladder disease within a year remains relatively common.

Cholelithiasis and Cholecystitis

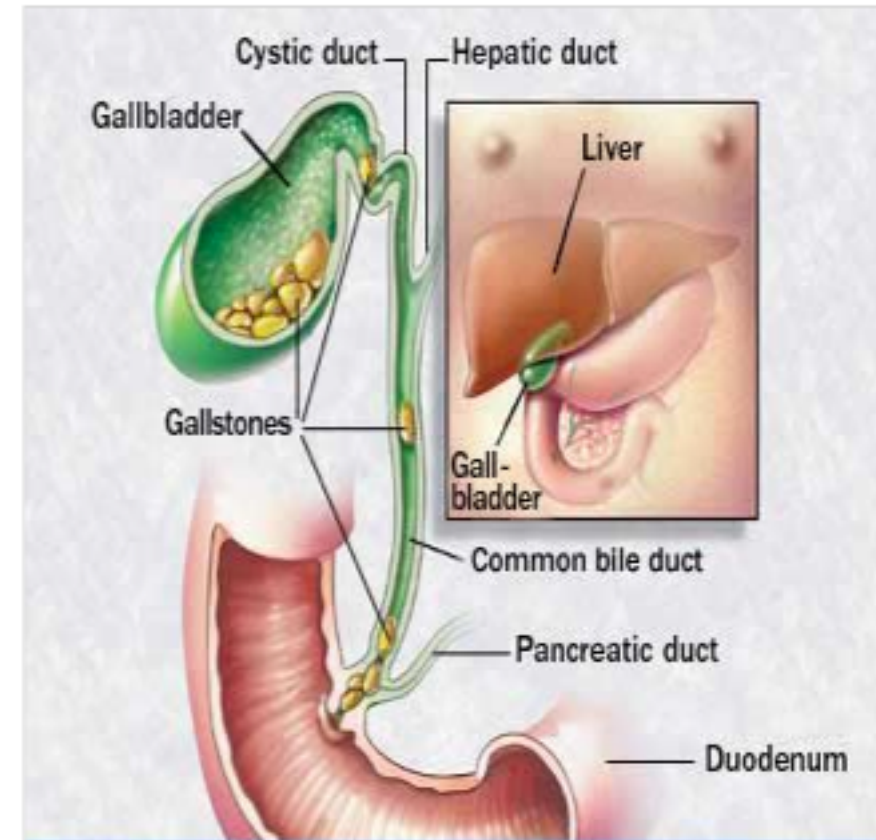
Biliary sludge, which may increase during pregnancy, is an important precursor to gallstone formation. (“**lithogenic**”)

Prophylactic cholecystectomy is not warranted for asymptomatic stones.

For symptomatic gallstone disease, nonsurgical approaches have been used

- → include oral bile acid therapy with ursodeoxycholic acid and extracorporeal shock wave lithotripsy → there is no experience with these during pregnancy.

Gallstones

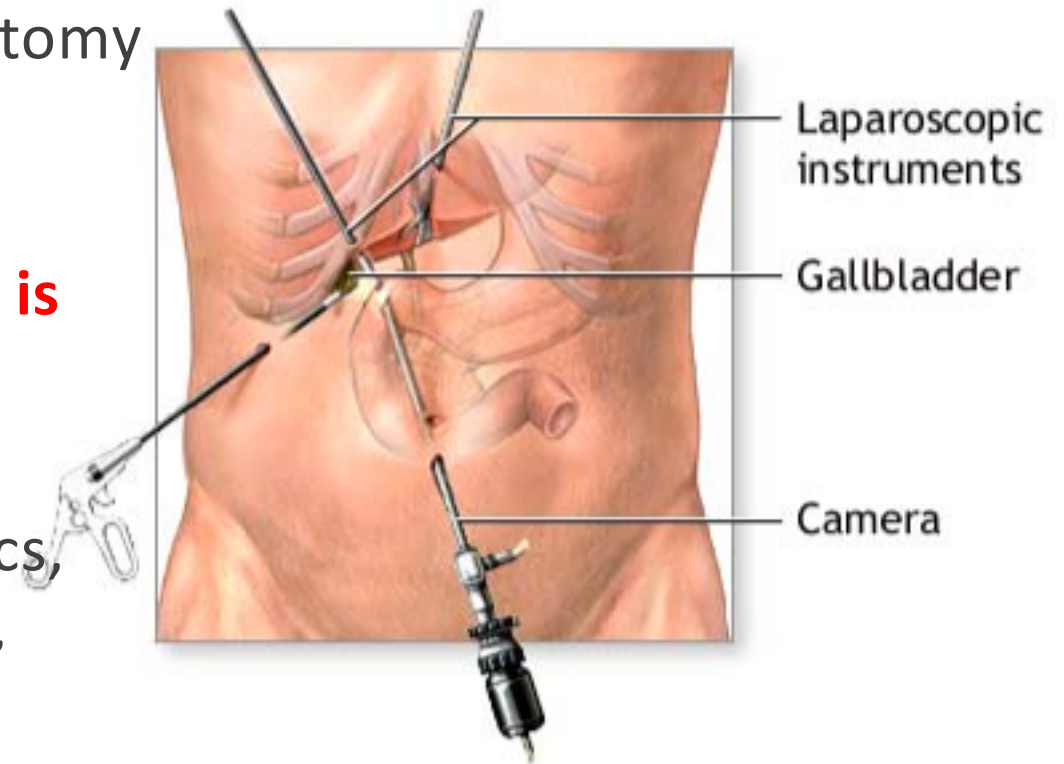


Cholelithiasis and Cholecystitis

- Acute cholecystitis usually develops when there is obstruction of the cystic duct. → Bacterial infection plays a role in 50 to 85 percent of cases.
- Pain is accompanied by anorexia, nausea and vomiting, low-grade fever, and mild leukocytosis.
- Symptomatic gallbladder disorders in young women include acute cholecystitis, biliary colic, and acute pancreatitis.

Cholelithiasis and Cholecystitis

- In most symptomatic patients, cholecystectomy is warranted.
- Although acute cholecystitis responds to medical therapy, **contemporary consensus is that early cholecystectomy is indicated**
- In acute cases, medical therapy consists of intravenous fluids, antimicrobials, analgesics, and in some instances, nasogastric suction, before surgical therapy.
- **Laparoscopic cholecystectomy** has become the preferred treatment for most patients.



Cholelithiasis and Cholecystitis

Medical versus Surgical Management

- Symptomatic cholecystitis is initially managed in a manner similar to that for nonpregnant women.
- In the past, most favored medical therapy.
- However, the recurrence rate during the same pregnancy is high, and 25 to 50 percent of women ultimately required cholecystectomy for persistent symptoms.
- Moreover, if cholecystitis recurs later in gestation, preterm labor is more likely and cholecystectomy technically more difficult.

Cholelithiasis and Cholecystitis

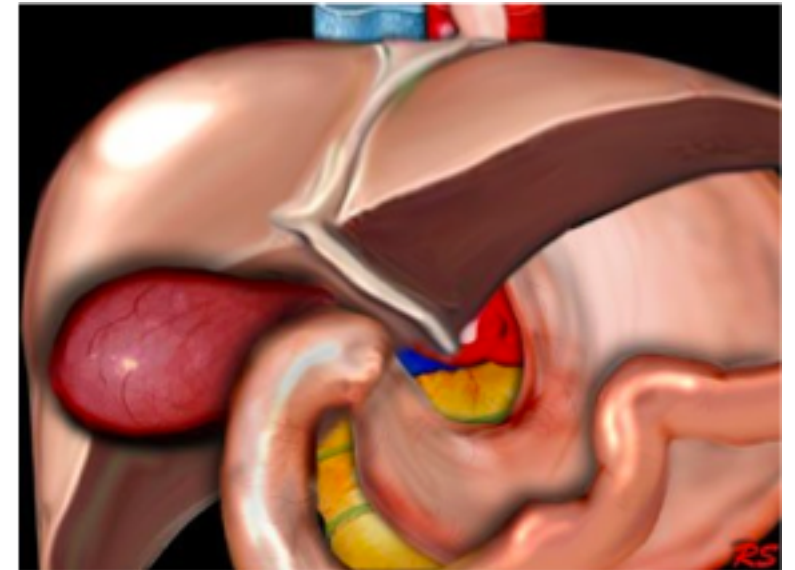
Medical versus Surgical Management

- For these reasons, operative and endoscopic interventions are increasingly favored over conservative measures.
- **women managed conservatively** had **more** pain, more recurrent visits to the emergency department, more hospitalizations, and a higher rate of cesarean delivery.
- **more complications** with conservative management of gallbladder disease in pregnancy → multiple admissions, prolonged total parenteral nutrition, and unplanned labor induction for worsening gallbladder symptoms.

Cholelithiasis and Cholecystitis

Medical versus Surgical Management

- Cholecystectomy was performed safely in all trimesters.
- no increased risk of preterm birth or fetal demise for operative compared with conservative management.



Trauma

Blunt Trauma

A. Physical Abuse/ Intimate Partner Violence

- The woman who is physically abused tends to present late, if at all, for prenatal care.
- **Immediate sequelae** included uterine rupture, preterm delivery, and maternal and perinatal death.
- Subsequent outcomes included increased rates of placental abruption, preterm and low-birthweight infants, and other adverse outcomes.

Automobile accidents

- Motor-vehicle crashes are the most common causes of serious, life-threatening, or fatal blunt trauma during pregnancy
- As with all motor vehicle crashes, alcohol use is commonly associated. But sadly, as many as half of accidents occur without seat-belt use, and many of these deaths would likely be preventable by the three-point restraints



3-point automobile restraint

Seat belts prevent contact with the steering wheel, and they reduce abdominal impact pressure

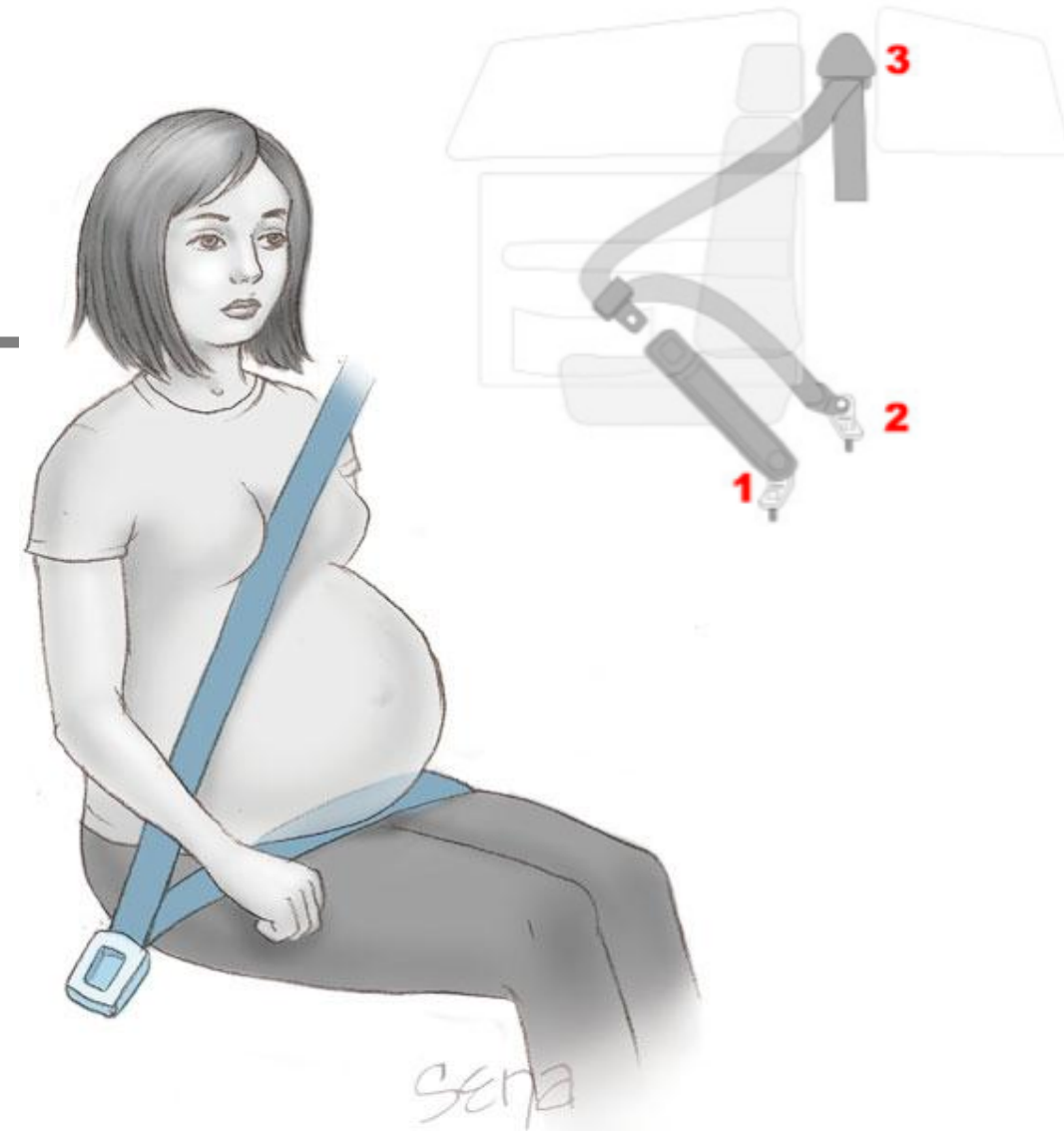


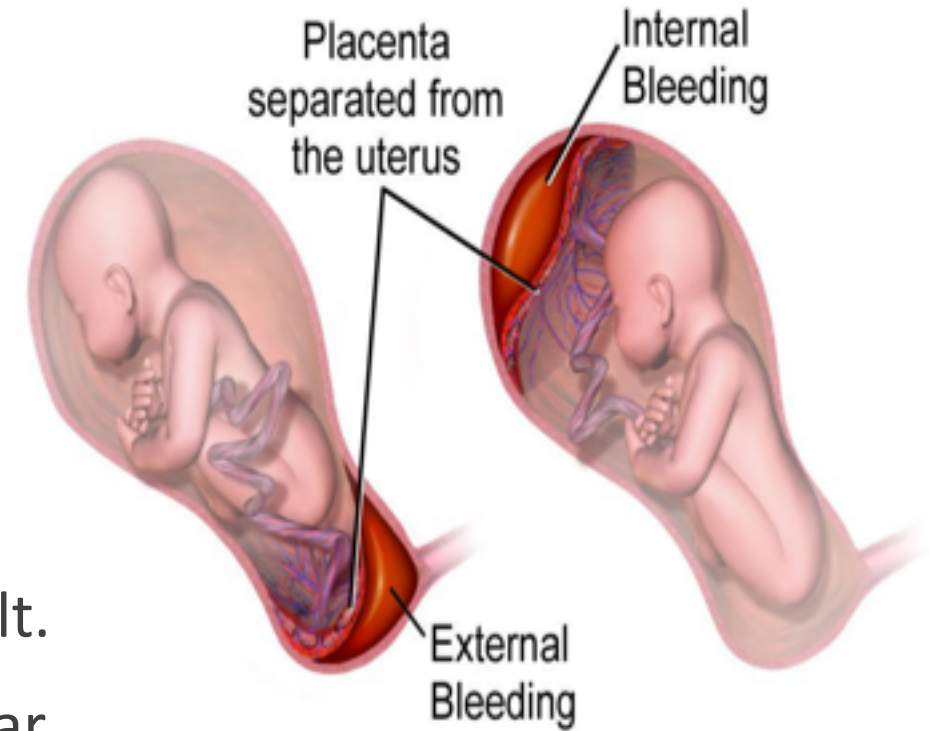
FIGURE 47-8 Illustration showing correct use of three-point automobile restraint. The upper belt is *above* the uterus, and the lower belt fits snugly across the upper thighs and well *below* the uterus.

Blunt Trauma: Fetal Injury and Death

- Perinatal death rates increase with the severity of maternal injuries.
- Fetal death is more likely with direct fetoplacental injury, maternal shock, pelvic fracture, maternal head injury, or hypoxia
- Fetal skull and brain injuries are **more likely if the head is engaged** and the maternal pelvis is fractured
- Fetal skull fractures are rare and best seen using **CT imaging**
- **Sequelae**: intracranial hemorrhage, paraplegia and contractures; fetal decapitation or incomplete midabdominal fetal transection at midpregnancy

Blunt Trauma: Placental Injuries—Abruptio or Tear

- **Catastrophic events** include placental injuries—abruption or placental tear—and uterine rupture
- Placental separation from trauma is likely caused by **deformation of the elastic myometrium around the relatively inelastic placenta**
- This may result from a deceleration injury as the large uterus meets the immovable steering wheel or seat belt.
- Clinical findings with traumatic abruptio may be similar to those for spontaneous placental abruption



Placental Abruptio

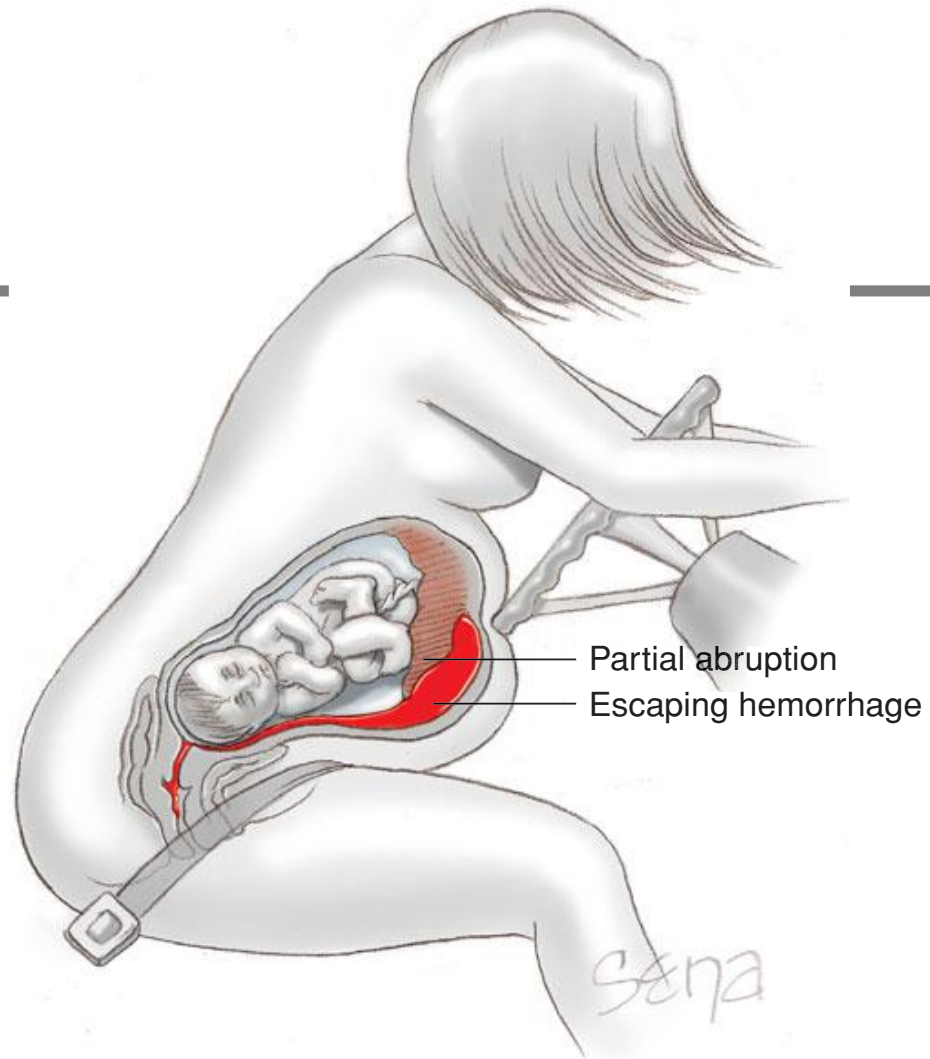


FIGURE 47-9 Acute deceleration injury occurs when the elastic uterus meets the steering wheel. As the uterus stretches, the inelastic placenta shears from the decidua basalis. Intrauterine pressures as high as 550 mm Hg are generated.

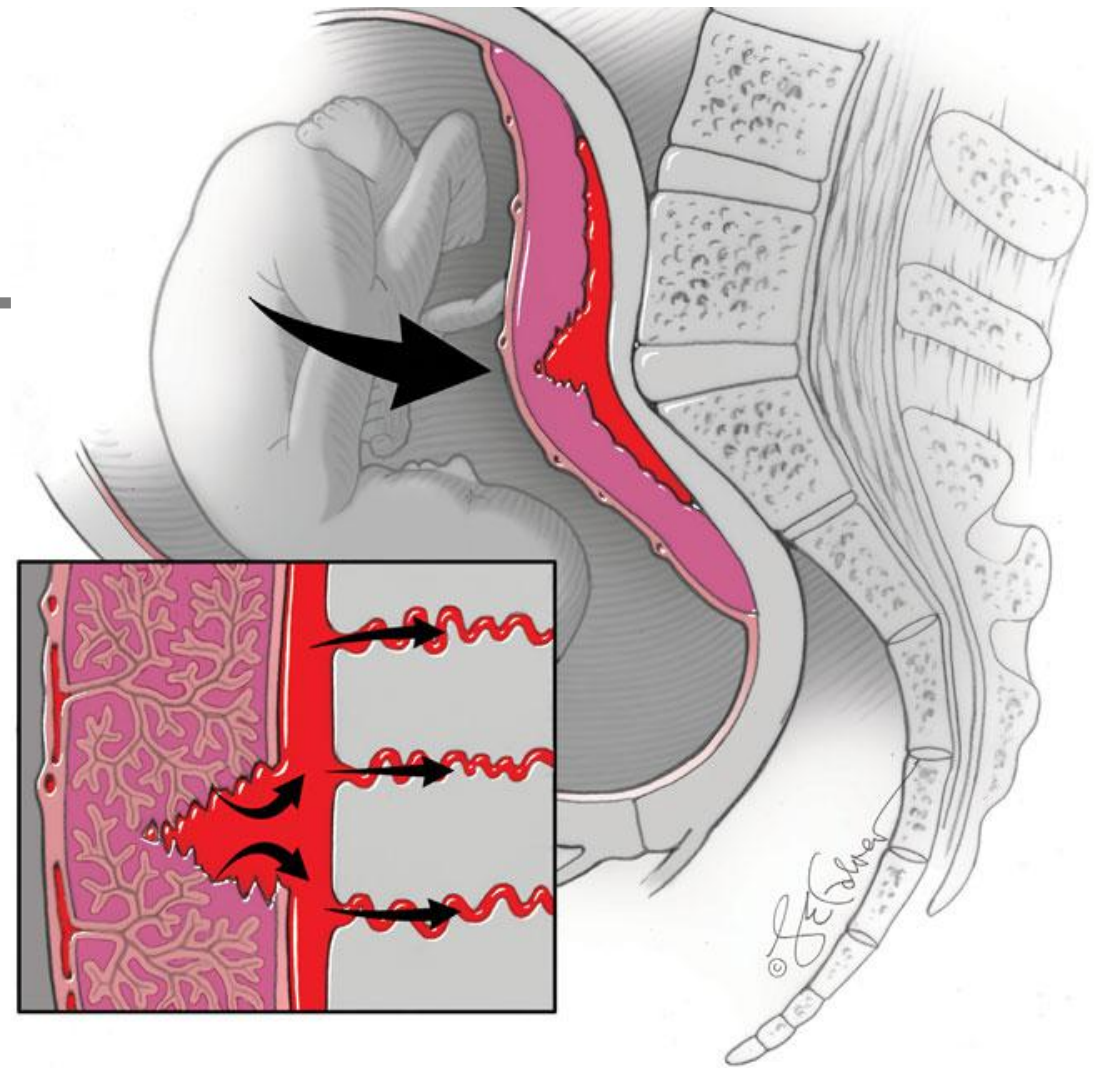
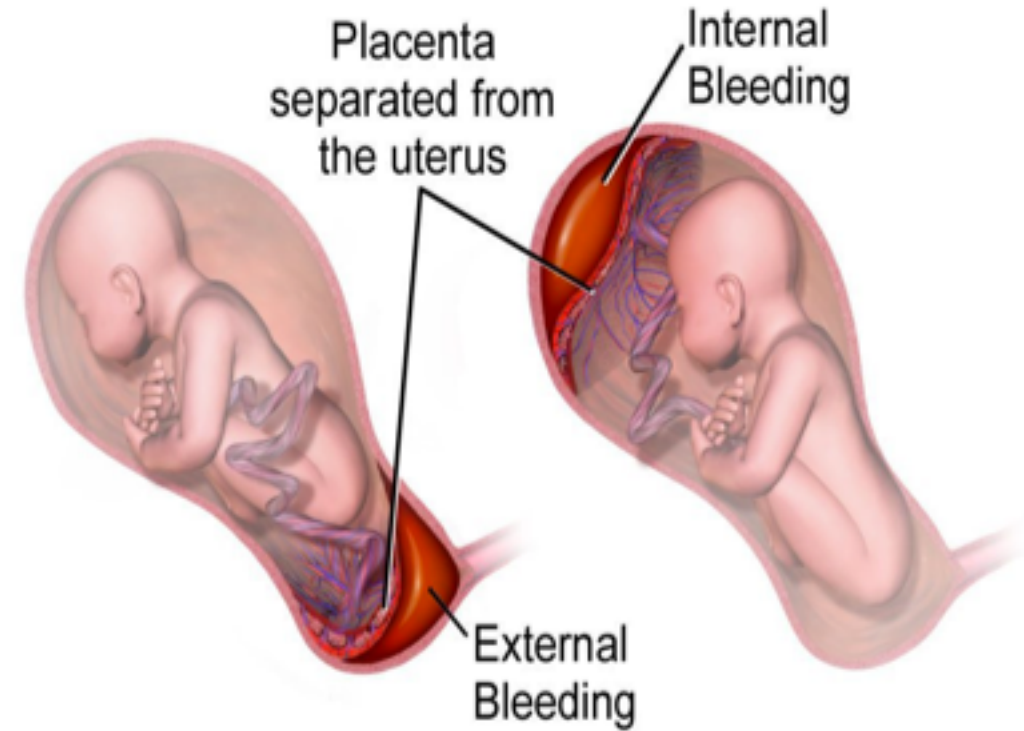


FIGURE 47-10 Mechanism of placental tear or "fracture" caused by a deformation-reformation injury. Placental abruption is seen as blood collecting in the retroplacental space. **Inset.** From here, blood can be forced into placental bed venules and enter maternal circulation. Such maternofetal hemorrhage may be identified with Kleihauer-Betke testing.

Blunt Trauma: Placental Injuries—Abruptio or Tear

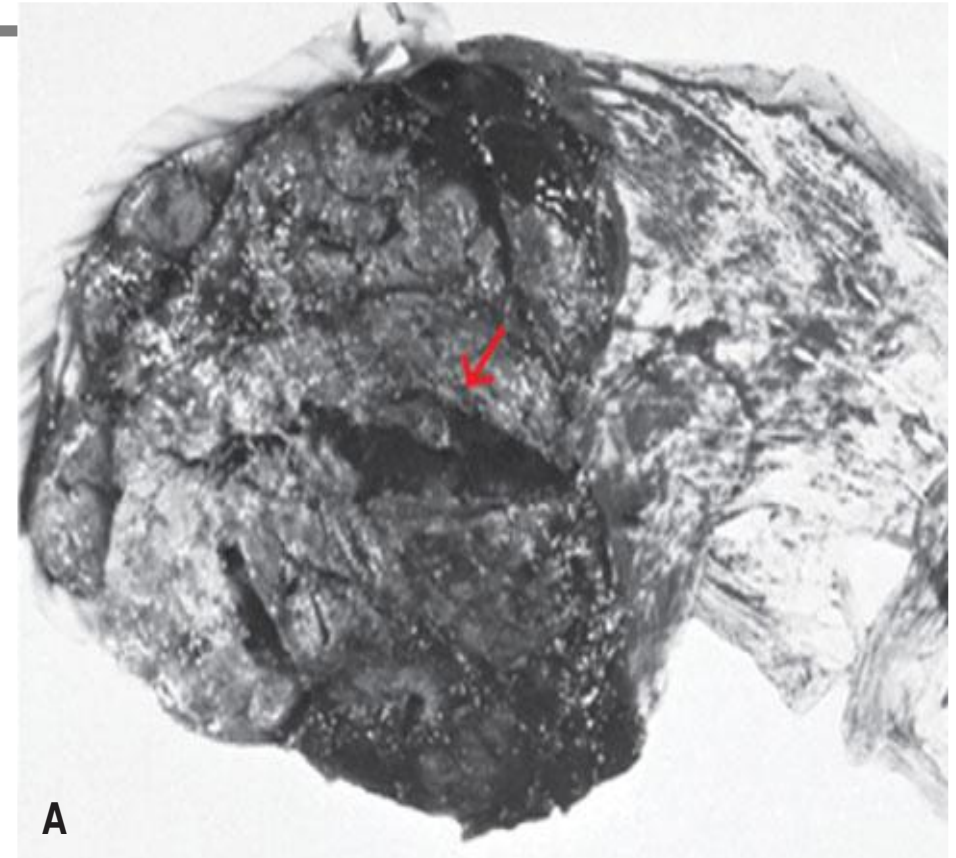
- Traumatic abruptio may be occult and unaccompanied by uterine pain, tenderness, or bleeding.
- Other features are evidence of fetal compromise such as fetal tachycardia, late decelerations, and acidosis and fetal death.



Placental Abruptio

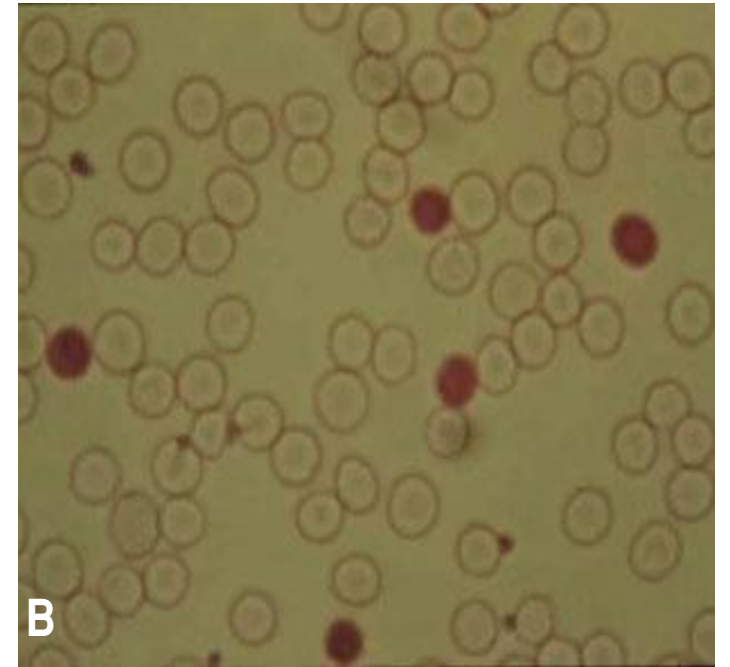
Blunt Trauma: Placental Injuries—Abruptio or Tear

- If there is considerable abdominal force associated with trauma, then the placenta can be torn, or “fractured”
- life-threatening fetal hemorrhage may be encountered either into the amnionic sac or by fetomaternal hemorrhage → tear is linear or stellate and is caused by rapid deformation and reformation.



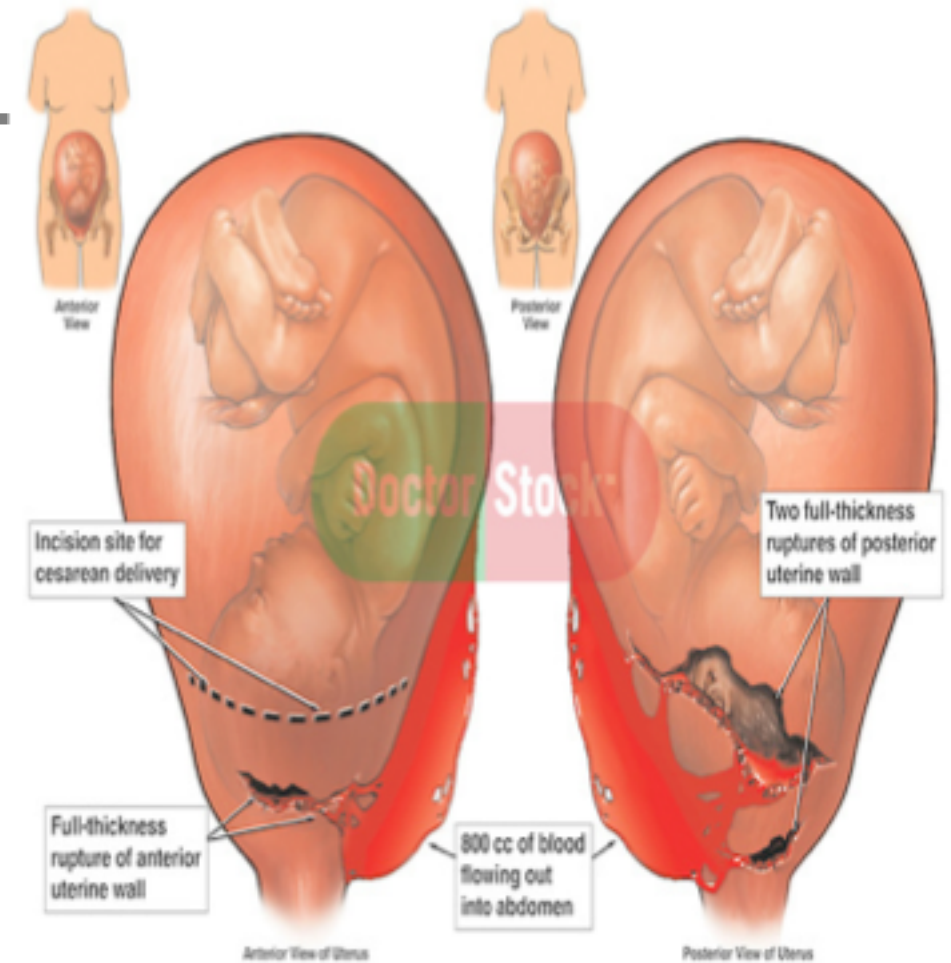
Blunt Trauma: Placental Injuries—Abruptio or Tear

- fetomaternal hemorrhage is quantified using a **Kleihauer-Betke (KB)** stain of maternal blood (acid elution test)
- With traumatic abruptio, massive fetomaternal hemorrhage may coexist → 20-fold risk of associated uterine contractions and preterm labor if there is evidence for a fetomaternal bleed



Blunt trauma: Uterine Rupture

- Blunt trauma results in uterine rupture in < 1 percent of severe cases
- Rupture is more likely in a **previously scarred uterus** and is usually associated with a **direct impact of substantial force**.
- Clinical findings may be **identical to those for placental abruption** with an intact uterus, and maternal and fetal deterioration are soon inevitable.



Management of Trauma

- Primary goals are **evaluation and stabilization** of maternal injuries.
- Attention to fetal assessment during the acute evaluation may divert attention from life-threatening maternal injuries
- Basic rules of resuscitation include ventilation, arrest of hemorrhage, and treatment of hypovolemia with crystalloid and blood products.
- Importantly, the **large uterus is positioned off the great vessels** to diminish its effect on vessel compression and decreased cardiac output.

Left uterine displacement (LUD)

>20 weeks gestational size or uterus is palpable or visible



Left Uterine Displacement
One handed Technique



Left uterine Displacement
- 2 Handed Technique



Figure 4. Patient in a 30° left-lateral tilt using a firm wedge to support pelvis and thorax.

Vanden Hoek. Circulation 2010;122:S861



Management of Trauma

- Following emergency resuscitation, evaluation is continued for fractures, internal injuries, bleeding sites, and placental, uterine, and fetal trauma.
- Screening abdominal sonography followed by CT scanning for positive sonographic findings.
- Procedures used include the **FAST scan**—focused assessment with sonography for trauma.
 - a 5-minute, four- to six-view imaging study that evaluates perihepatic, perisplenic, pelvic, and pericardial views
 - If fluid is seen in any of these views, then the volume is > 500 mL.

Management of Trauma

- Penetrating injuries in most cases must be evaluated using **radiography**.
- Because clinical response to peritoneal irritation is blunted during pregnancy, an **aggressive approach to exploratory laparotomy is pursued**.
- Diagnostic laparoscopy has also been used



Management of Trauma

Electronic fetal Monitoring

- fetal well-being may reflect the status of the mother → fetal monitoring is another “vital sign” that helps to evaluate the extent of maternal injuries.
- Even if the mother is stable, electronic monitoring may suggest placental abruption.
- In these cases, abnormal tracings were common and included fetal tachycardia and late decelerations.



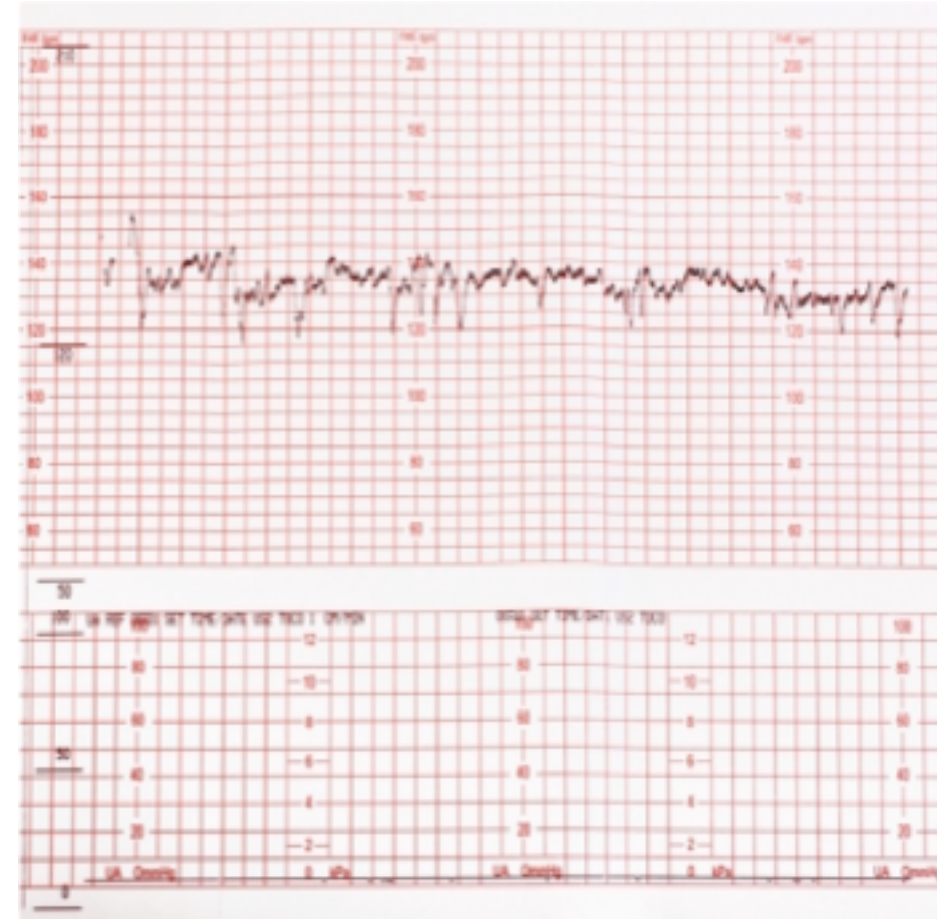
Management of Trauma

Electronic fetal Monitoring

begun as soon as the mother is stabilized.

observation for **4 hours** is reasonable with a normal tracing and no other sentinel findings such as contractions, uterine tenderness, or bleeding.

monitoring should be continued as long as there are uterine contractions, nonreassuring fetal heart patterns, vaginal bleeding, uterine tenderness or irritability, serious maternal injury, or ruptured membranes



Management of Trauma

Cesarean Delivery

The necessity for cesarean delivery of a live fetus depends on several factors:

- gestational age
- fetal condition
- extent of uterine injury
- whether the large uterus hinders adequate treatment or evaluation of other intraabdominal injuries



Management of Trauma

- ensure that maternal tetanus immunization is current.
- When indicated, a dose of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine (Tdap) is preferred for its neonatal pertussis immunity benefits



CARDIOPULMONARY RESUSCITATION

There are special considerations for cardiopulmonary resuscitation (CPR) conducted in the second half of pregnancy, and these are outlined in the American Heart Association 2010 guidelines

Standards for critically ill pregnant women:

- (1) relieve possible vena caval compression by left lateral uterine displacement,
- (2) administer 100-percent oxygen,
- (3) establish intravenous access above the diaphragm,
- (4) assess for hypotension that warrants therapy, which is defined as systolic blood pressure < 100 mmHg or < 80 percent of baseline, and
- (5) review possible causes of critical illness and treat conditions as early as possible.

CARDIOPULMONARY RESUSCITATION

- In nonpregnant women, external chest compression results in a cardiac output approximately 30 percent of normal.
- In late pregnancy, this may be even less with CPR because of uterine aortocaval compression → Thus, it is paramount to accompany other resuscitative efforts with uterine displacement.

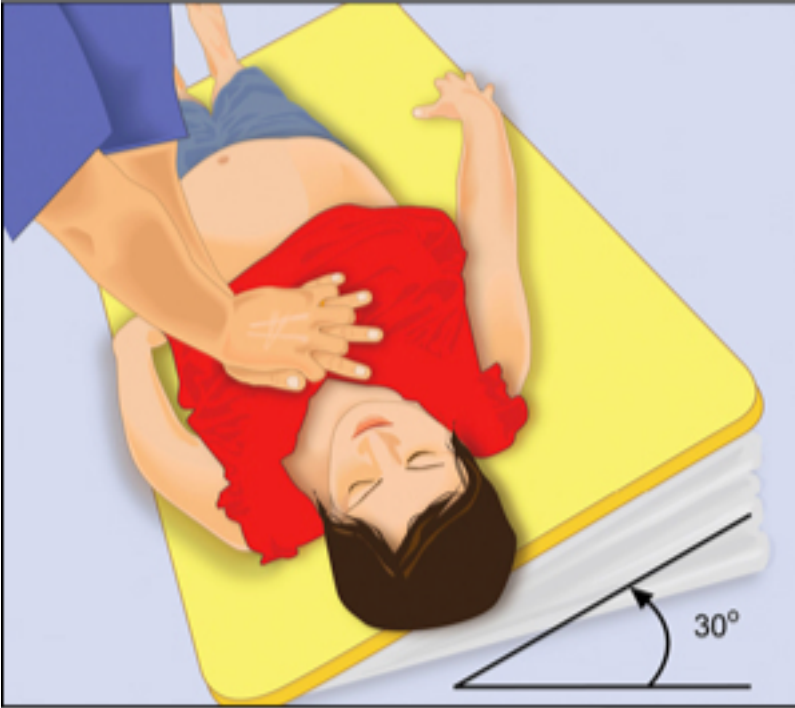


CARDIOPULMONARY RESUSCITATION

- Displacement (LUD) can be accomplished by tilting the operating table laterally, by placing a wedge under the right hip—an example is the Cardi resuscitation wedge, or by pushing the uterus to the left manually .
- If no equipment is available, such as in an out-of-hospital arrest, an individual may kneel on the floor with the maternal back on his or her thighs to form a “human wedge”



CARDIOPULMONARY RESUSCITATION



Left uterine displacement (LUD)

>20 weeks gestational size or uterus is palpable or visible



Left Uterine Displacement
One handed Technique



Left uterine Displacement
- 2 Handed Technique



Figure 4. Patient in a 30° left-lateral tilt using a firm wedge to support pelvis and thorax.

Vanden Hoek. Circulation 2010;122:S861



CPR in pregnant women

- The patient should be placed in a full left lateral decubitus position to relieve aortocaval compression (*Class I; Level of Evidence C*).
- Administration of 100% oxygen by face mask to treat or prevent hypoxemia is recommended (*Class I; Level of Evidence C*).
- Intravenous access should be established above the diaphragm to ensure that the intravenously administered therapy is not obstructed by the gravid uterus (*Class I; Level of Evidence C*).



Source: Winkler JJ, et al. Resuscitation 1998; 41: 1-10. Ms. A. 31y, G1P0, 36w, 10kg, 160cm, 50kg.

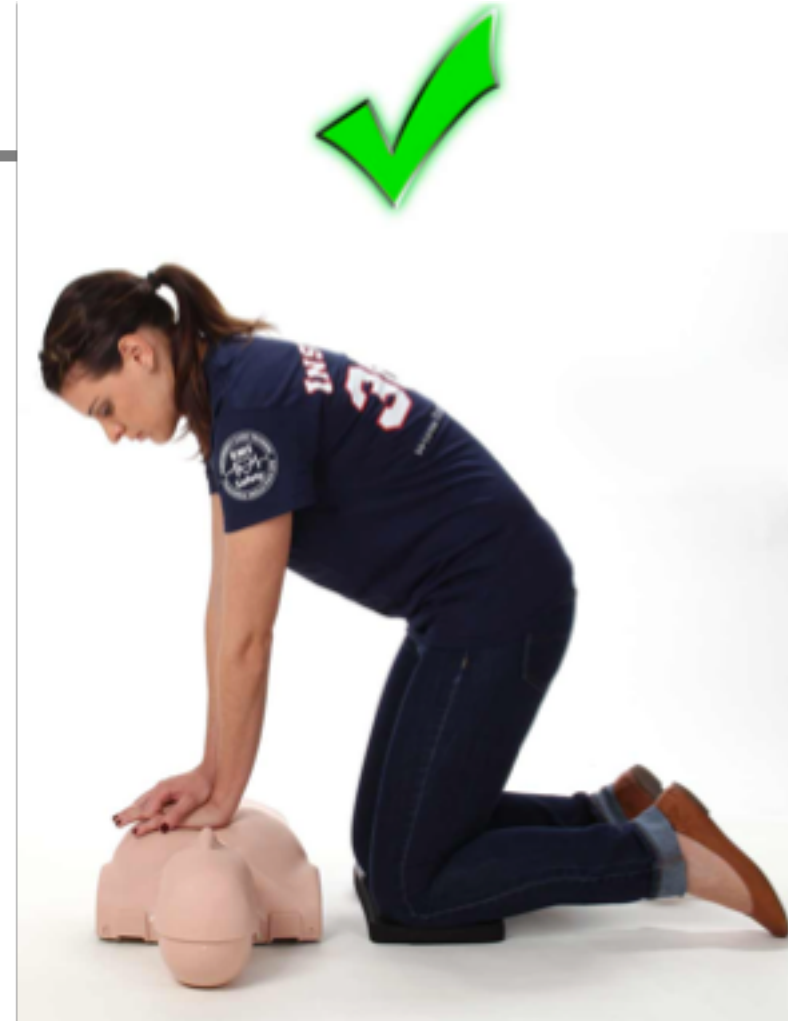
CPR in pregnant women

- Chest compressions should be performed at a rate of at least 100 per minute at a depth of at least 2 in (5 cm), allowing full recoil before the next compression, with minimal interruptions (*Class IIa; Level of Evidence C*).
- The patient should be placed supine for chest compressions (*Class I; Level of Evidence C*).



CPR in pregnant women

- Hypoxemia should always be considered as a cause of cardiac arrest. Oxygen reserves are lower and the metabolic demands are higher in the pregnant patient compared with the nonpregnant patient; thus, early ventilatory support may be necessary (*Class I; Level of Evidence C*).
- The rescuer should place the heel of 1 hand on the center (middle) of the victim's chest (the lower half of the sternum) and the heel of the other hand on top of the first so that the hands overlap and are parallel (*Class IIa; Level of Evidence C*).



CPR in pregnant women

- The same currently recommended defibrillation protocol should be used in the pregnant patient as in the nonpregnant patient. There is no modification of the recommended application of electric shock during pregnancy (*Class I; Level of Evidence C*).
- The patient should be defibrillated with biphasic shock energy of 120 to 200 J (*Class I; Level of Evidence B*) with subsequent escalation of energy output if the first shock is not effective and the device allows this option.



CPR in pregnant women

- Fetal assessment should not be performed during resuscitation (*Class I; Level of Evidence C*).
- Fetal monitors should be removed or detached as soon as possible to facilitate CPR without delay or hindrance (*Class I; Level of Evidence C*).
- Medication doses do not require alteration to accommodate the physiological changes of pregnancy. Although there are changes in the volume of distribution and clearance of medication during pregnancy, there are very few data to guide changes in current recommendations (*Class IIb; Level of Evidence C*).

CPR in pregnant women

- In the setting of cardiac arrest, no medication should be withheld because of concerns about fetal teratogenicity (*Class IIb; Level of Evidence C*).
- Physiological changes in pregnancy may affect the pharmacology of medications, but there is no scientific evidence to guide a change in current recommendations. Therefore, the usual drugs and doses are recommended during ACLS (*Class IIb; Level of Evidence C*).

CPR in pregnant women

- Administering 1 mg epinephrine IV/IO every 3 to 5 minutes during adult cardiac arrest should be considered. In view of the effects of vasopressin on the uterus and because both agents are considered equivalent, epinephrine should be the preferred agent (*Class IIb; Level of Evidence C*).
- It is recommended that current ACLS drugs at recommended doses be used without modifications

LAPAROSCOPIC SURGERY during pregnancy

Laparoscopy during pregnancy

- has become the most common first-trimester procedure used for diagnosis and management of several surgical disorders
- The most frequently performed procedures: cholecystectomy, adnexal surgery, and appendectomy.
- Laparoscopic adnexal mass surgery in pregnancy is preferred, and its relative safety is attested to by several investigators
- At first, **26 to 28 weeks** became the upper gestational age limit recommended, but as experience has continued to accrue, many now describe laparoscopic surgery performed in the third trimester.



TABLE 46-2. Some Guidelines for the Performance of Laparoscopic Surgery in Pregnancy

Indications—same as for nonpregnant women

Adnexal mass excision

Investigation of acute abdominal processes

Appendectomy, cholecystectomy, nephrectomy, adrenalectomy, splenectomy

Timing—all trimesters

Technique

Position: left lateral recumbent

Entry: open technique, careful Veress needle, or optical trocar; fundal height may alter insertion site selection

Trocars: direct visualization for placement; fundal height may alter insertion site selection

CO₂ insufflation pressures: 10–15 mm Hg

Monitoring: capnography intraoperatively,

FHR assessment pre- and postoperatively

Perioperative pneumatic compression devices and early postoperative ambulation

CO₂ = carbon dioxide; FHR = fetal heart rate.

Summarized from Pearl, 2011.

Laparoscopy during pregnancy

Hemodynamic Effects

- Abdominal insufflation for laparoscopy causes hemodynamic changes that are similar in pregnant and nonpregnant women
- Cardiorespiratory changes are generally not severe if insufflation pressures are kept below 20 mm Hg.
- mean arterial pressures, systemic vascular resistance, and heart rate did not change significantly.

TABLE 46-3. Physiological Effects of CO₂ Insufflation of the Peritoneal Cavity

System	Effects ^a	Mechanisms	Possible Maternal-Fetal Effects
Respiratory	Pco ₂ increases, pH decreases	CO ₂ absorption	Hypercarbia, acidosis
Cardiovascular	Increased—heart rate; systemic vascular resistance; pulmonary, central venous, and mean arterial pressures Decreased—cardiac output	Hypercarbia and increased intraabdominal pressure Decreased venous return	Uteroplacental hypoperfusion—possible fetal hypoxia, acidosis, and hypoperfusion ^b
Blood flow	Decreased splanchnic flow with hypoperfusion of liver, kidneys, and gastrointestinal organs Decreased venous return from lower extremities Increased cerebral blood flow	Increased intraabdominal pressure Increased intraabdominal pressure Hypercarbia possibly from shunting due to splanchnic tamponade	

^aEffects intensified when insufflation pressure > 20 mm Hg in baboons (Reedy, 1995).

^bData primarily from animal studies.

CO₂ = carbon dioxide; CSF = cerebrospinal fluid; Pco₂ = partial pressure of CO₂.

Data from O'Rourke, 2006; Reynolds, 2003.

Laparoscopy during pregnancy

Technique

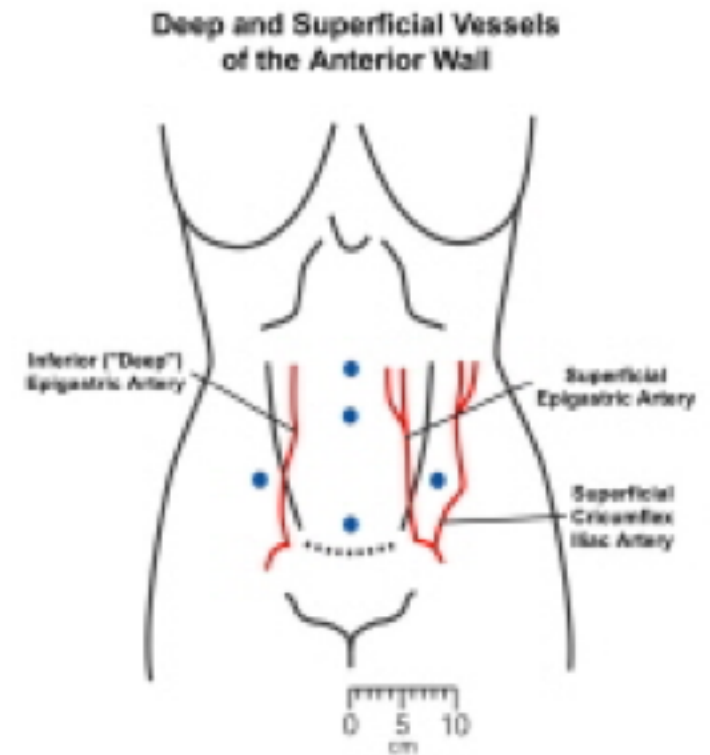
- Bowel cleansing empties the large intestine and may aid visualization.
- Nasogastric or orogastric decompression reduces the risk of stomach trocar puncture and aspiration.
- Aortocaval compression is avoided by a left-lateral tilt.
- Positioning of the lower extremities in boot-type stirrups maintains access to the vagina for fetal sonographic assessment or manual uterine displacement.
- Vaginally placed instruments that enter the cervix or uterus for uterine manipulation should not be used during pregnancy.

Laparoscopy during pregnancy

Technique

Beyond the first trimester, technical modifications of standard pelvic laparoscopic entry are required to avoid uterine puncture or laceration:

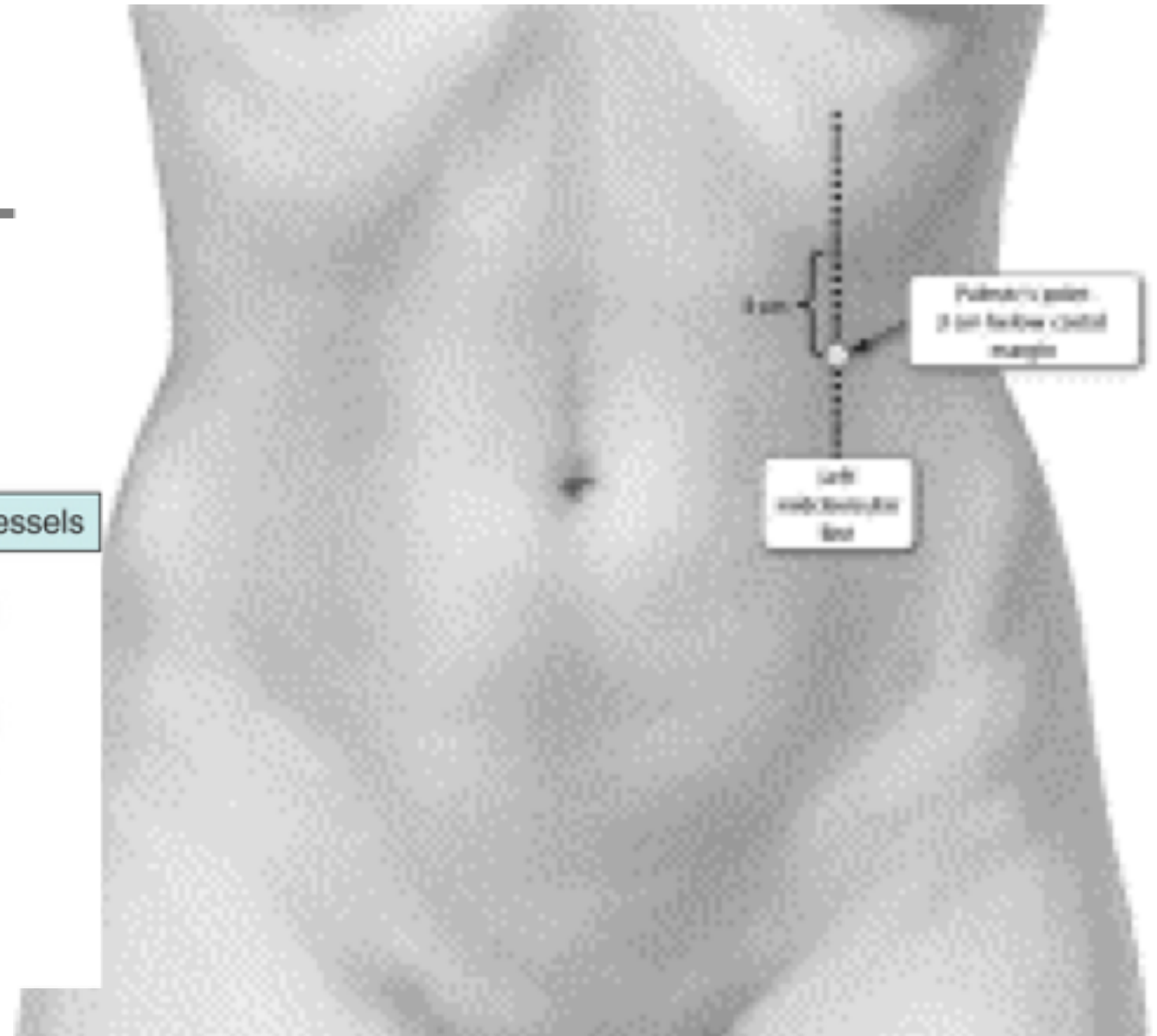
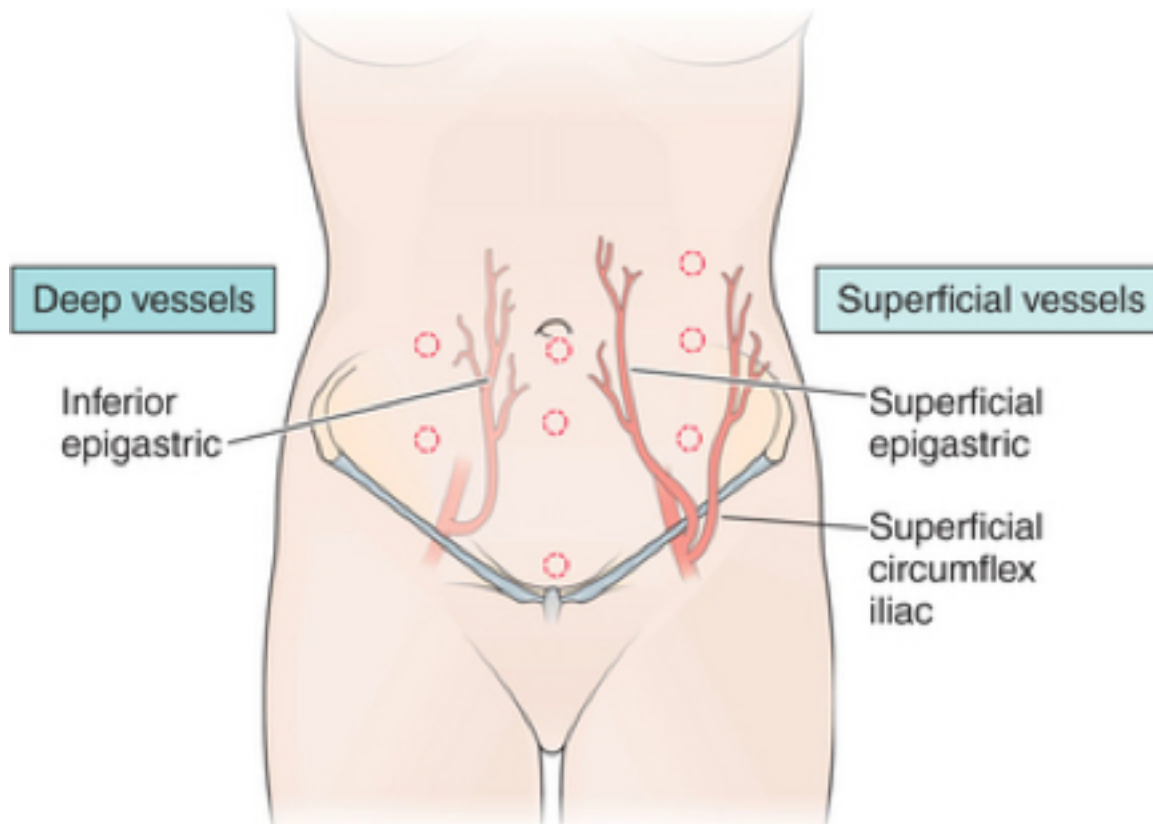
- Many recommend open entry techniques to avoid perforations of the uterus, pelvic vessels, and adnexa
- The abdomen is incised at or above the umbilicus, and the peritoneal cavity entered under direct visualization.
- At this point, the cannula is then connected to the insufflation system, and a 12-mm Hg pneumoperitoneum is created.



Laparoscopy during pregnancy

Technique

- The initial insufflation should be conducted slowly to allow for prompt assessment and reversal of any untoward pressure-related effects.
- Insertion of secondary trocars into the abdomen is most safely performed under direct laparoscopic visual observation through the primary port.
- In more advanced pregnancies, direct entry through a left upper quadrant port in the midclavicular line, 2 cm beneath the costal margin, has been described → **Palmer point** → this entry site is used in gynecological laparoscopy because visceroparietal adhesions uncommonly form here



Laparoscopy during pregnancy

- **Complications**

- Risks inherent to any abdominal endoscopy are possibly increased slightly during pregnancy.
- reported complications are infrequent
- The obvious unique complication is perforation of the pregnant uterus with either a trocar or Veress needle

Outline

1. Physiologic changes in pregnancy
2. Surgical complications
3. CPR in pregnancy
4. Laparoscopy in pregnancy

RX PRESCRIPTION

NAME _____

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Thank you!

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