

Pregnancy, Intra-Abdominal

Nathaniel N. Hsu

Risk

- Incidence in USA: 11:100,000 live births and 9:1000 ectopic pregnancies.
- Higher incidence in African Americans, Asians, and immigrant populations from third-world countries.
- Risk factors include PID, tubal damage, intrauterine contraceptive devices, assisted reproductive techniques, previous ectopic, and previous pelvic surgery.
- Maternal mortality 100 times that of intrauterine pregnancy.
- Perinatal mortality ranges from 40–95%.

Perioperative Risks

- Misdiagnosis prior to delivery is not uncommon, and a high index of suspicion is important for Dx. In one case series, only 6 of 10 pts were diagnosed preop.
- Massive hemorrhage may occur anytime in the periop setting.

Worry About

- Severe hemorrhage depending on location of placental implantation in the abdomen.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
CV	Hemorrhage	Postural dizziness, shortness of breath	Hypovolemia, hypotension, tachycardia	Hgb, Hct
GI	Bowel obstruction GI bleed if bowel implantation	N/V, abdominal pain, distended rigid abdomen	GI bleed	Abdominal x-ray, CT, MRI, abdominal US
CNS			Decreased consciousness if massive hemorrhage	

Key References: Kunwar S, Khan T, Srivastava K: Abdominal pregnancy: methods of hemorrhage control, *Intractable Rare Dis Res* 4(2):105–107, 2015; Arendt KW: Problems of early pregnancy. In Chestnut DH, Wong CA, Tsen LC, et al., editors: *Chestnut's obstetric anesthesia: principles and practice*, 5th edition, Philadelphia, PA, 2014, Elsevier, pp 340–357.

Perioperative Implications

Preoperative Preparation

- Assess volume status and optimize maternal cardiovascular status, usually with intravascular volume replacement.
- Obtain large bore IV access, draw blood to assess hematocrit, and type and crossmatch.

Monitoring

- Urethral cath to monitor urine output.
- Consider invasive monitoring (arterial cath and/or central venous cath).

- Decreased placental perfusion and oligohydramnios, leading fetal growth restriction, pulmonary hypoplasia, and anatomic deformities.

Overview

- Defined as implantation in the peritoneal cavity, not including the fallopian tubes, ovaries, or ligaments.
- Early pregnancy may be normal and subsequently presenting with midtrimester abdominal pain, N/V, shock, partial bowel obstruction, and vaginal bleeding.
- Differential Dx includes abruptio placentae, placenta previa, uterine rupture, pelvic inflammatory disease, and bowel obstruction. MRI is better than US diagnosis. US may miss diagnosis in >50% of cases.
- Exsanguinating intraabdominal bleeding can occur at any time.
- No abnormal trend in serial hCG values compared to that seen in tubal pregnancies.

Etiology

- Often results from a missed ruptured tubal ectopic pregnancy.

Usual Treatment

- Emergency diagnostic laparoscopy or exploratory laparotomy with delivery of the fetus. However, expectant management has been successful in case reports with very close monitoring.
- Excision of placenta can result in life-threatening hemorrhage but, leaving it in situ, may yield higher infectious risk.
- Methotrexate or arterial embolization can be used to accelerate placental involution.
- Rare phenomena may occur where an unrecognized abdominal pregnancy dies and calcifies leading to formation of lithopedion or “stone baby.”

Induction

- GA with rapid-sequence using ketamine or etomidate if there is concern for significant hypotension in response to propofol

Maintenance

- Monitor for hemorrhage and resuscitate with crystalloid/blood products as needed.

Extubation

- May need to delay extubation for postop care.
- Extubate awake.

Postoperative Period

- May require multidisciplinary ICU for those who had massive transfusion or significant hypotension

Anticipated Problems/Concerns

- Massive hemorrhage, DIC.
- If massive blood transfusion is needed, be aware of possible dilutional thrombocytopenia and need for coagulation factor replacement.

Pregnancy, Maternal Physiology

Stephanie R. Goodman

Risk

- Estimated 6.4 million pregnancies in USA, resulting in 4.1 million live births per year.
- Pregnancy rate is 102 pregnancies per 1000 women between the ages of 15–44 y.

Perioperative Risks

- Maternal mortality rate is 28 deaths per 100,000 live births in USA, with 210 deaths per 100,000 live births in the world.
- Hemorrhage, hypertension, and embolic disorders are leading causes of maternal deaths.
- Risks of maternal mortality include advanced maternal age, obesity, multifetal pregnancies, C-section, and African American race.

Worry About

- Difficult airway, including inability to intubate and ventilate due to maternal wt gain, breast enlargement,

and swelling of oropharyngeal tissues (incidence of failed intubation 1:280 vs. 1:2230 in nonpregnant pts).

- Hypoxemia occurs more quickly during periods of apnea due to decreasing FRC and increasing O₂ consumption.
- Aortocaval compression causing decreased uteroplacental perfusion and FHR late decelerations.
- Hypercoagulability causing DVT/PE.
- Obesity as an independent risk factor for adverse pregnancy outcomes.

Overview

- Physiologic changes occur during pregnancy to allow maternal adaptation to the demands of the growing fetus and supporting placental unit and ultimately to facilitate labor and delivery.
- These changes affect almost every organ system and influence the anesthetic and periop management of the pregnant woman.

- Adjust drug doses and administration schedules to compensate for increased volume of distribution, decreased peak plasma drug concentration, increased elimination T_{1/2}, and increased renal excretion.

Etiology

- Profound increases in hormonal concentrations, especially progesterone
- Mechanical effects of an enlarging uterus
- Increased metabolic demand
- Presence of the low resistance placental circulation

Usual Treatment

- Normal spontaneous vaginal delivery
- C-section

Assessment Points				
System	Effect	Assessment by Hx	PE	Test
HEENT	Capillary engorgement/swelling of nasal and oral pharynx, larynx, trachea Vocal cords and arytenoid edema	Epistaxis Voice changes Difficult nasal breathing/congestion	Careful airway exam Temporomandibular distance Mallampati class Neck ROM	Sleep study for OSA
CV	CO, SV, HR, ejection fraction increased SVR, BP decreased Third and fourth heart sounds Systolic ejection murmur Tricuspid and pulmonic regurgitation Peripheral edema	Palpitations Dizziness/presyncope	Auscultation of heart Pulse BP	ECG, ECHO
RESP	Tidal volume, respiratory rate increased FRC decreased Minute and alveolar ventilation increased PaO ₂ increased, PaCO ₂ decreased Elevated diaphragm	Dyspnea	Auscultation of lungs RR	CXR, ABG, PFTs (all rarely needed)
GI	Decreased lower esophageal sphincter tone Decreased gastric emptying (only in labor) Decreased gallbladder emptying	GE reflux Gallstones		Endoscopy, RUQ US
RENAL	Increased RBF, GFR, Cr clearance Decreased bicarbonate	Increased drug clearance		Decreased BUN, Cr, bicarbonate
HEME	Much increased plasma volume, increased RBC volume Increased coagulation factors (I, VII, VIII, IX, X, XII), increased clotting Increased platelet turnover, fibrinolysis Decreased albumin, α ₁ acid glycoprotein	Physiologic anemia Leg pain, dyspnea Gestational thrombocytopenia	Pale, nail beds Homan sign for DVT	Hg, Hct PT/PTT, lower extremity Doppler, V/Q scan, spiral CT Plt count, TEG
CNS	Decreased MAC Increased pain threshold			
ENDO	Increased insulin resistance Enlarged thyroid, decreased TSH		Palpation of thyroid gland	Glucose Normal free T ₃ and T ₄
MS	Increased lumbar lordosis Increased joint mobility	Back pain		

Key References: Gaiser R: Physiologic changes of pregnancy. In Chestnut DH, editor: *Obstetric anesthesia: principles and practice*, ed 4, Philadelphia, PA, 2009, Mosby, pp 15–36; May L: Cardiac physiology of pregnancy. *Compr Physiol* 5(3):1325–1344, 2015.

Perioperative Implications

Preoperative Preparation

- Large-bore IV; consider a second IV if pt is at increased risk for bleeding.
- Consider use of nonparticulate antacids and/or metoclopramide to decrease gastric acid and volume.
- Keep pt with left uterine displacement to relieve aortocaval compression.
- Good oropharynx exam to assess likelihood of difficult intubation.
- Recommend NPO 6–8 h prior to elective surgery.

Monitoring

- Routine

Preinduction/Induction

- Need access to difficult airway equipment, including FOB, LMAs, and video laryngoscopes.
- Use a short or stubby-handled laryngoscope, especially in obese parturients.
- Avoid nasal intubation due to increased risk of bleeding.
- Preoxygenate with 100% O₂ at high-flow rates.
- Use rapid sequence induction and cricoid pressure (Sellick maneuver) to decrease passive regurgitation of gastric acid into oropharynx.

- ETT preferred to LMA to adequately protect against aspiration.
- Pseudocholinesterase activity reduced, but recovery from succinylcholine usually not prolonged.
- Decreased doses of induction agents needed.

Maintenance

- Adjust ventilation to maintain PaCO₂ around 30 mm Hg.
- Decreased MAC for inhalation anesthetics.
- Avoid high dose inhalation agents due to uterine atony.
- High doses of opioids and/or benzodiazepines given prior to delivery can cause resp depression in the neonate.

Extubation

- Awake without residual NM blockade

Regional Anesthesia

- Spinal, epidural, and combined spinal-epidural are all possible techniques and usually preferred over GA for surgical delivery, especially in the obese pt or one with apparent difficult airway.
- Decreased dose of spinal or epidural local anesthetic achieves the same dermatomal level as higher doses in nonpregnant adults.

- Pharmacologic sympathectomy can cause severe hypotension at term.
- Reduced response to vasopressors.

Postoperative Period

- Pain can be treated with a combination of NSAIDs and preservative-free spinal or epidural morphine or IV PCA if GA is used.
- Use compression stockings, prophylactic heparin, and/or early ambulation to lower the risk of DVT/PE.
- Most physiologic changes of pregnancy resolve 6–8 wk postpartum.

Anticipated Problems/Concerns

- Mallampati scores worsen during the progress of labor, so the airway must be examined immediately prior to induction of GA.
- Uterine artery blood flow is 500 mL/min at term, so obstetric hemorrhage can become life-threatening very quickly.
- Increased risk of C-section with obesity is a common and increasing problem.