Chapter 11
Trauma in Pregnancy

Marcos Mavromaras, Christina Bird, Julie Gorchynski, and Linda Hatch

Introduction

Trauma, specifically motor vehicle collisions (MVC), intimate partner violence (IPV), and falls, represents the majority of non-obstetric fatalities during pregnancy [1, 2]. Seven percent of all pregnancies are affected as a result of trauma [3]. The incidence of trauma increases with gestational age, and over half of traumatic events involving pregnant women occur in the third trimester [3]. While nine out of ten traumatic events in pregnancy are considered minor, 60–70% of fetal losses occur following a minor maternal injury [4]. Pregnancy itself may be considered an independent risk factor for trauma with recent data reporting an increase in IPV among pregnant women [5]. Other risk factors for trauma include younger age (<25 years), substance or alcohol use, improper use of seatbelts, and low maternal educational or socioeconomic level [6–9]. MVC comprise approximately 50% of all traumas in pregnancy with IPV and falls comprising approximately 22% [1, 3, 10–12].

Emergency physicians often evaluate pregnant women after minor and serious trauma. An understanding of the anatomical and physiological changes during pregnancy as well as injuries unique to the pregnant patient is critical. The optimal management of the pregnant trauma patient involves a multidisciplinary team of emergency physicians, obstetricians, trauma surgeons, and neonatologists. Emergency physicians are in a unique position to educate pregnant patients on injury prevention including proper seatbelt use as well as screen for IPV.

M. Mavromaras, M.D. • C. Bird, D.O. (✉) • J. Gorchynski, M.D. • L. Hatch, M.D.
Department of Emergency Medicine, UT Health Science Center,
MC7736, 7703 Floyd Curl Drive, San Antonio, TX 78229, USA
e-mail: mavromaras@uthscsa.edu; birdc@uthscsa.edu; gorchynski@uthscsa.edu

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Common Mechanisms of Trauma in Pregnancy

Motor Vehicle Collisions

Motor vehicle collisions are the leading cause of trauma in pregnancy, and 82% of traumatic fetal deaths occur following an MVC. Lack of seatbelt use or incorrect belt placement increases the risk of intrauterine injury and fetal death and is the major risk factor for adverse outcomes following MVC [4, 13]. Indeed, unrestrained pregnant women in MVC are twice as likely to have preterm delivery within 48 h and 2.8 times more likely to experience a fetal death than if they were appropriately restrained [14, 15]. Compliance with seatbelt usage and proper placement of seatbelts are decreased in pregnant women. There is a false impression that seatbelts "will hurt the baby." Pregnant women often incorrectly position restraints, which make the restraints less effective in preventing injury to both mother and fetus. Three-point restraint should include the shoulder strap resting between the breasts and around gravid abdomen, while the lap portion should rest snugly over the hips below the gravid abdomen [16]. Higher level of education appears to correlate with increased seatbelt usage among this population [17]. Emergency physicians should educate and encourage pregnant patients regarding diligent usage and proper placement of seatbelts.

Intimate Partner Violence

One in five teens and one in six adult women experience IPV during pregnancy, amounting to approximately 335,000 cases in the United States annually [18]. Risk factors associated with IPV during pregnancy include substance abuse, witnessed domestic violence as a child, low maternal educational or socioeconomic level, unplanned pregnancy, history of prior IPV, and unmarried status [19]. IPV may occur for the first time during pregnancy, or the severity of violence may escalate [20]. Pregnant victims of IPV are at risk for both immediate- and long-term sequelae such as placental abruption, uterine rupture, prematurity, and low birth weight infants, respectively, resulting in maternal and fetal mortality [18, 21, 22]. Since 2013, the US Preventive Services Task Force has recommended screening of all women of childbearing age for IPV in the emergency department (ED).

Falls

Pregnant women are at higher risk of falling as gait is affected by weight gain and increased joint laxity and postural stability is decreased. Indeed, one in four women will fall during the course of their pregnancy [13]. Most falls occur indoors, and 39% are associated with stairs [23]. Falls often result in orthopedic injuries, with fractures of the lower extremities being most common [24]. Isolated orthopedic injuries place the pregnant patient at significantly higher risk for adverse obstetric outcomes including preterm birth, placental abruption, low birth weight infants, and

increased perinatal mortality. Additionally, there is a ninefold increased risk of thrombotic events following orthopedic injury [10]. For these reasons, emergency physicians should have a low threshold for observing and monitoring pregnant patients after even minor isolated orthopedic injuries.

Anatomic and Physiologic Considerations in Pregnancy

The uterus is relatively protected within the pelvis until between 8 and 12 weeks after which it starts to ascend, reaching the level of the umbilicus at approximately 20 weeks [25]. The ascending and enlarging uterus displaces the intestine and stomach upward, changing the location of abdominal pain. From the second trimester forward, the peritoneum may be less irritable due to the peritoneum and abdominal musculature being stretched from the gravid uterus [26]. There can be significant trauma within the pelvis and abdomen without peritoneal signs [27]. The unreliability of the abdominal exam may lead to delayed diagnoses of internal injuries [28]. Between 8 and12 weeks, the bladder also ascends slightly into the abdomen, itself becoming more susceptible to injury. The diaphragm may be up to 4 cm higher than in a nonpregnant patient, which, on imaging, may cause an apparent widened mediastinum, enlarged cardiac silhouette, and decreased lung volumes. Additionally, this may result in a left axis shift and flattened T waves on ECG (Fig. 11.1).

Emergency Department Evaluation and Management

Primary Survey

The general principles of Advanced Trauma Life Support (ATLS) apply to all pregnant trauma patients, with a few exceptions. The first priority of management of the pregnant trauma patient is to attend to the mother. Optimal care of the mother amounts to optimal fetal care. The ED evaluation of the pregnant trauma patient begins with a rapid and thorough assessment of the mother with simultaneous initiation of IV crystalloids, supplemental oxygen, and left lateral decubitus positioning to avoid hypotension. Vital signs in pregnant trauma patients are unique in that pregnant women normally have relative tachycardia, hypotension, and tachypnea due to physiological changes of pregnancy.

Early recognition of pregnancy is critical in the trauma patient. All women of childbearing age presenting with trauma should have a pregnancy test performed. In one study, 8% of pregnant women that were admitted to a trauma center were unaware they were pregnant [29]. The abdomen should be palpated for a gravid uterus. It is widely accepted that a clinical estimation of gestational age of ≥24 weeks, which correlates with a fundal height of 3–4 finger breaths above the umbilicus, corresponds to a potentially viable fetus and an increased likelihood of extrauterine survival [27].

Successful management of the pregnant trauma patient requires a multidisciplinary approach including a trauma surgeon, obstetrician, and neonatologist

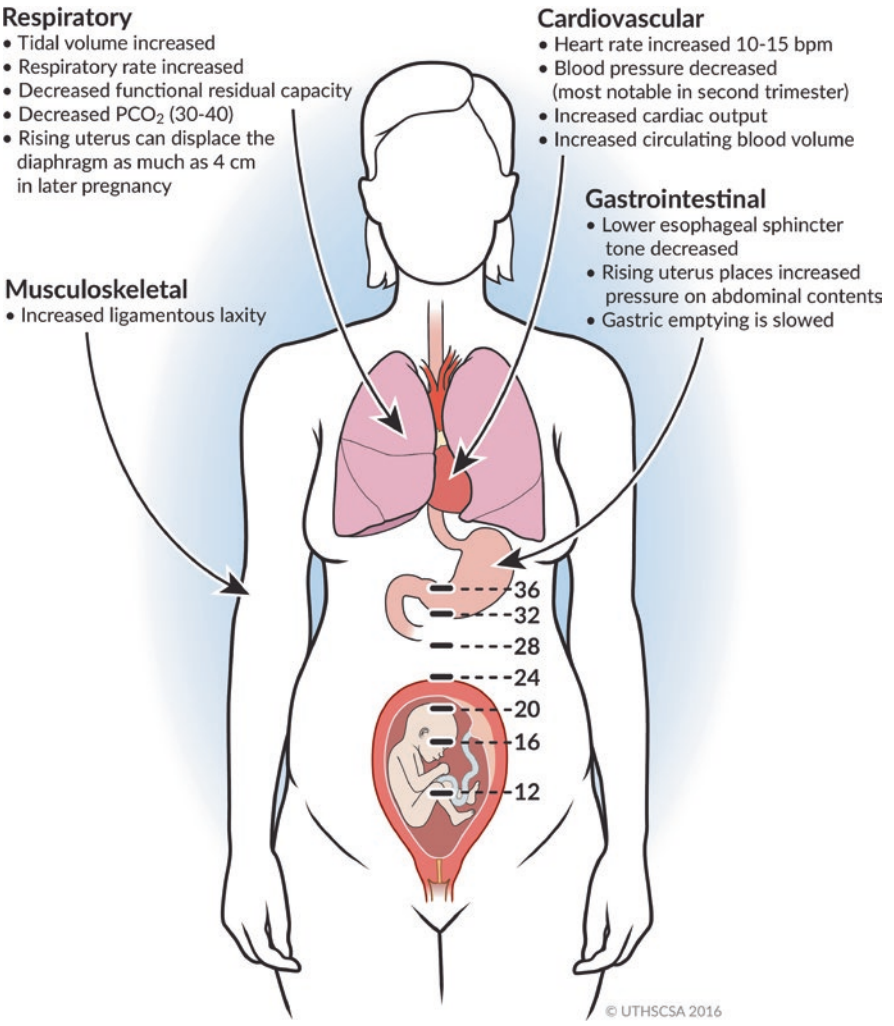

Fig. 11.1 Anatomic and Physiologic Considerations of Pregnancy

working in conjunction with the emergency physician. The emergency physician must weigh the resources available at their facility and be prepared to mobilize and coordinate other resources if they should become necessary. Many minor trauma patients present to non-trauma centers, and even innocuous appearing injuries may have potentially life-threatening implications to the fetus or mother. Therefore, transfer to a trauma center or a facility that has continuous fetal cardiotocographic monitoring capabilities is strongly encouraged.

Airway

Due to the risk of fetal hypoxia, early airway management is highly recommended in caring for the pregnant trauma patient, especially if the patient is obtunded or displaying

signs of respiratory compromise [25]. The emergency physician should have a low threshold for intubation and mechanical ventilation and anticipate a difficult airway [30].

Intubation failure rate has been reported to be higher in pregnant patients due to the various anatomical and physiological changes that occur in pregnancy. Diaphragmatic elevation decreases forced vital capacity. The relative hypocapnia of pregnancy, together with a baseline decrease in functional residual capacity and residual volume, results in decreased oxygen reserves. There is a propensity toward faster desaturation during rapid sequence intubation (RSI); therefore preoxygenation is vital [31–35]. Normal pregnancy causes fluid retention and weight gain resulting in mucosal edema and therefore narrower airways. This also increases airway resistance and decreases overall respiratory system compliance. Endotracheal tubes with diameters 0.5–1.0 mm smaller than standard tube sizes should be used on the first attempt, with smaller tubes prepared as backup [36]. In addition, there is increased aspiration risk during intubation for the pregnant trauma patient due to the ascending and enlarging uterus which places increased pressure on intestinal and stomach contents; at the same time progesterone-mediated smooth muscle relaxation reduces the tone of the lower esophageal sphincter [37, 38]. A low threshold for the placement of a nasogastric tube for gastric decompression prior to RSI is recommended.

The majority of RSI medications, including paralytics, analgesics, anesthetics, or sedatives, are category C under the FDA pregnancy pharmacology safety guidelines (Table 11.1). Exceptions include ketamine, which is category B, and benzodiazepines that are category D (Table 11.2). There are no current recommendations or guidelines to suggest the use of one medication over another or dose adjustments for RSI in the pregnant patient [31–33].

Breathing

If mechanical ventilation is initiated, minute ventilation should be managed to maintain $PaCO_2$ levels around 30–32 mm Hg, as hypocapnia is physiologic in late pregnancy. A $PaCO_2$ >32 mmHg in a pregnant patient suggests respiratory insufficiency and a level >40 mmHg, respiratory failure [30]. Fetal survival is entirely dependent upon uterine perfusion and oxygen delivery.

Avoidance of an acidotic state is essential as it is thought to result in uterine vasoconstriction [34].

Targets of SaO2 > 95% and PaO2 > 70 mm Hg ensure fetal oxygen delivery; PaO2 < 60 mmHg has been associated with compromise of fetal oxygenation [28, 35, 37, 39]. In the event of a pneumo−/hemothorax, the chest tube should be placed 1–2 interspaces higher due to diaphragmatic elevation in order to avoid entering the abdomen [25].

Table 11.1 FDA drug risk classification in pregnancy[a]

Category	Description
A	Controlled studies in humans show no risk to the fetus
B	Animal studies show no risk to the fetus, no controlled studies in humans
C	No controlled studies in animals or humans
D	Evidence of human risk to the fetus exists; however benefits may outweigh risks
X	Controlled studies demonstrate fetal abnormalities. Risk outweighs any possible benefit

[a]As of 2014 the FDA is changing drug labeling regarding its use during pregnancy or lactation and phasing out the letter categories [61]

Table 11.2 Safety profiles of commonly used medications

Category	Medications	Safety profile
Paralytics	Rocuronium	B
	Succinylcholine	C
	Vecuronium	C
Analgesics/sedatives	Ketamine	B
	Propofol	B
	Opiates	C
	Benzodiazapines	D
	Dexmedetomidine	C
Vasopressors	All	C
Antiemetics	Ondansetron	B
	Metoclopramide	B
	Phenothiazines	C
	Pyridoxine (vitamin B6)	A

Circulation

Plasma blood volume steadily increases throughout pregnancy; therefore a pregnant patient may lose up to 2 L of blood before showing any signs of circulatory instability [25]. Cardiac output is also increased and can result in rapid hemorrhage. Serum HCO3 < 19 may be an early indication of circulatory compromise.

In the event of hemorrhage, the fetus is at risk for reduced blood supply because maternal circulation preferentially shunts blood away from the uterus. Furthermore, uterine compression of abdominal and pelvic vasculature after 20-week gestation can result in decreased venous return and resultant "supine hypotensive syndrome." Patients should be placed in the left lateral decubitus position when possible or the uterus should be manually displaced to the left of the midline [26, 40, 41]. Angulations of the patient on the backboard to achieve a slight left lateral decubitus position of 15° to 30° or right lateral decubitus positioning are acceptable alternatives [30, 40]. Intravenous (IV) access, whether central or peripheral, should be established above the level of the diaphragm due to possible uterine compression of abdominal and pelvic vasculature [30].

When treating a pregnant trauma patient, the clinician should avoid the pitfall of attributing hypotension to supine hypotensive syndrome and should ensure that the patient is not hemorrhaging. Recommendations on resuscitative blood pressure goals are extrapolated from perioperative cesarean section patients. The American Heart Association (AHA) recommends a goal for systolic blood pressure (SBP) of >100 mm Hg or greater than 80% of the patient's baseline blood pressure [42]. Alternatively, the mean arterial pressure (MAP) can be targeted to a value of >65 mmHg as extrapolated from studies in nonpregnant patients. In order to maintain uterine perfusion, hypotension should be aggressively managed. Urinary output is the most sensitive prognosticator of maternal cardiovascular collapse [43]. It is recommended that early requisition and utilization of blood products, specifically CMV antibody-negative or leukocyte-reduced, Rh-negative products, must be transfused in a 2:1:1 (red blood cell/plasma/platelets) ratio given the relative hemodilution in pregnant women [44]. Vasopressors may reduce uterine flow and therefore placental perfusion, but the benefits of correcting maternal hemodynamics are

of primary concern. The preferential use of phenylephrine has increased in popularity due to recent studies demonstrating less hypotension and improved fetal acid-base status compared to the once previously utilized ephedrine [45].

Secondary Survey

The secondary survey should proceed according to ATLS guidelines in the same fashion as nonpregnant women with the addition of fetal heart rate monitoring initiated in the ED if available. Patients who suffer direct abdominal trauma or who present with contractions, vaginal bleeding, or uterine tenderness are more likely to have obstetric complications [46]. All pregnant women should have a sterile bimanual exam performed to evaluate for the presence of the fetus, fetal body parts, umbilical cord, placenta, or uterus within the vaginal vault and to determine if any disruption of the rectal and vaginal mucosa has occurred. The clinician should also assess for ruptured membranes or acute vaginal hemorrhage. Any of these findings require immediate surgical and obstetric consultations for imminent fetal delivery in a more controlled environment. Placental abruption, uterine rupture, and preterm labor may occur following even minor abdominal trauma [3, 25]. Bedside focused assessment of sonography in trauma (FAST) can determine the presence of free fluid, pneumothorax, hemothorax, pericardial effusion, and uterine rupture, if present. In the rare event that diagnostic peritoneal lavage is performed, a supraumbilical open approach is recommended to avoid inadvertent uterine injury.

Uterine contractions are the most common presenting obstetric symptoms after abdominal trauma and are usually self-limited [27]. The identification of pathologic contractions is important as they may have deleterious effects on the fetus. Tocolysis may be necessary depending on the gestational age of the fetus in consultation with an obstetrician. Terbutaline 0.25 mg subcutaneous is recommended as the first-line agent and intravenous magnesium as an adjunct [25]. If the fetus is between 24 and 34 weeks, corticosteroids and betamethasone 12 mg or dexamethasone 6 mg intramuscular (IM) should be given to promote fetal lung maturity if delivery seems probable [25].

Diagnostic Studies

Laboratory Tests

Initial laboratory tests include pregnancy test, complete blood count (CBC), complete metabolic panel (CMP), coagulation studies, lactate, and blood type and cross match. Because plasma volume increases during pregnancy, a mild decrease in hematocrit is physiologic; however, in the setting of trauma, there is always the possibility of ongoing blood loss. Standard parameters for lab values such as CMP, coagulation studies, and lactate are largely unchanged in the pregnant trauma population. Specific predictors of fetal hypoxia include a decrease in hematocrit of greater than 50%, PaO_2 <60 mmHg (O_2 sat<90%), as well as acidosis. Increased minute ventilation and tidal volume result in a relative hypocapnia and respiratory

alkalosis with baseline $PaCO_2$ of 30 mmHg; a $PaCO_2$ of 40 mmHg indicates CO_2 retention. However, serum pH can generally normalize due to renal compensation.

Type and cross match with Rh status should be included in a basic trauma lab set. Reportedly, as little as 0.001 mL of fetal blood in the maternal circulation can sensitize an Rh-negative mother [47]. Therefore rhesus immune globulin (RhIG) should be administered to all Rh-negative mothers following even minor trauma. In the first trimester, one 50 mcg intramuscular dose is sufficient prophylaxis. In the second and third trimesters, 300 mcg is needed to provide prophylaxis for up to 30 mL of fetal-maternal hemorrhage. There is no harm in giving the more readily available 300 mcg dose to women in the first trimester. The Kleihauer-Betke (KB) quantifies the amount of fetal-maternal hemorrhage, and KB analysis may have a role in directing the obstetrician in administering additional doses of RhIG in small subset of women where fetal-maternal hemorrhage may be in excess of 30 mL [3]. The results of the KB test will not impact ED care. Some literature reports higher rates of preterm labor in patients with a positive KB test [48]. Flow cytometric assay has been useful in quantifying fetal-maternal hemorrhage in preference to the KB technique [49]. The initial dose of RhIG prevents Rh isoimmunization up to 72 h following antigenic exposure.

Imaging

Decisions regarding imaging in pregnant trauma patients are often fraught with apprehension. The potential risk associated with ionizing radiation exposure to the fetus should be considered when obtaining imaging studies; however maternal resuscitation is of primary concern. A necessary diagnostic test should not be withheld out of concern for the fetus. Radiation harm to the fetus and risk of teratogenesis is greatest during the 8th through the 15th week of gestation when organogenesis occurs [10] (Table 11.3). Exposure to ionizing radiation doses above 100–200 mGy is associated with intrauterine growth retardation and CNS defects, such as microcephaly and mental retardation. Ionizing radiation doses less than 50 mGy have not been associated with difference in overall pregnancy outcomes. The fetal dose without shielding is approximately 30% of that to the mother [3]. Redundant imaging should be avoided, for example, if a patient is getting computed tomography (CT) scans of the abdomen and pelvis, and then the pelvic x-ray may not be necessary [3].

Ultrasound carries no risk of ionizing radiation and is considered safe during pregnancy [50]. M-mode imaging should be used instead of spectral Doppler imaging to document fetal heart rate [50]. FAST scan is an effective modality to identify free intra-abdominal fluid with greater than 90% specificity but with 61% sensitivity [51]. Chest and pelvic x-rays are the more commonly ordered images in trauma. Chest X-ray should be done with abdominal shielding in known pregnant patients. Most X-rays are considered very low-dose examinations and pose almost no risk to the fetus [52]. While CT studies confer the most radiation risk, the studies most commonly used in trauma evaluation expose the fetus to ionizing radiation doses well below 50 mGy [53] (Table 11.4). Magnetic resonance imaging (MRI) is considered safe in pregnancy; however gadolinium is contraindicated due to possible teratogenic effects [53]. Often in trauma, time is of the essence and MRI may not be practical.

Table 11.3 Effects of gestational age and radiation dose on radiation-induced teratogenesis

Gestational period	Effects	Estimated threshold dose[a]
Before implantation (0–2 weeks after conception)	Death of embryo or no consequence (all or none)	50–100 mGy
Organogenesis (2–8 weeks after conception)	Congenital anomalies (skeleton, eyes, genitals)	200 mGy
	Growth retardation	200–250 mGy
Fetal period		
8–15 Weeks	Severe mental retardation (high risk)[b]	60–310 mGy
	Intellectual deficit	25 IQ point loss per gray
	Microcephaly	200 mGy
16–25 Weeks	Severe mental retardation (low risk)	250–280 mGy

[a]Data based on results of animal studies, epidemiologic studies of survivors of the atomic bombings in Japan, and studies of groups exposed to radiation for medical reasons (e.g. radiation therapy for carcinoma of the uterus)

[b]Because this is a period of rapid neuronal development and migration

Patel S J, Reede D L, Katz D S, et al. Imaging the pregnant patient for nonobstetric conditions: Algorithms and radiation dose considerations. RadioGraphics 2007;27:1705–1722. With permission

Traumatic Injuries Specific to the Pregnant Patient

Abruptio Placenta

Abruption occurs when the placenta becomes separated from the uterine wall and is most commonly due to shearing forces related to trauma. Abruption has been reported to occur in up to 2–4% of even minor trauma. Patients may present with abdominal or pelvic pain with or without vaginal bleeding. The clinical signs and symptoms may be subtle. The amount of vaginal bleeding does not necessarily reflect the severity of the abruption, as a large hemorrhage can be concealed behind the placenta. Abruptions of less than 50% commonly result in fetal distress. Fetal demise almost always occurs in the event of greater than 50% abruption unless the fetus can be immediately delivered [27]. In patients beyond 24 weeks, continuous cardiotocodynamometry is the most sensitive predictor of abruption after trauma [25]. In one study, all cases of placental abruption showed frequent contractions, more than eight per hour, in the initial 4 h of electronic fetal monitoring [54]. Ultrasound has a sensitivity of 24% and 96% specificity [22, 49, 55]. Therefore, a negative ultrasound cannot exclude placental abruption. When positive, ultrasound shows retroplacental hemorrhage that is hyperechoic. Lab values such as elevated D-dimer, decreased fibrinogen, and elevated fibrin split products are associated with abruption but are neither sensitive nor specific [25].

Table 11.4 Fetal radiation doses associated with common radiological examinations

Type of examination	Fetal absorbed dose[a] (mGy)
Very low-dose examinations (<0.1 mGy)	
• Cervical spine X-ray (AP and lateral)	<0.001
• Any extremity X-ray	<0.001
• Chest X-ray (two views)	0.0005–0.01
Low- to moderate-dose examinations (0–10 mGy)	
Radiography	
• Thoracic spine X-ray	0.003
• Abdominal X-ray	0.1–3
• Lumbar spine X-ray	1–10
• Intravenous pyelography	5–10
• Double-contrast barium enema	1–20
CT	
• Head, neck, or extremity[b]	0–10
• Chest CT or CT pulmonary angiography	0.01–0.66
Nuclear medicine	
• Low-dose perfusion scintigraphy	0.1–0.5
• V/Q scintigraphy	0.1–0.8
Higher-dose examinations (10–50 mGy)	
• Abdominal CT	1.3–35
• Pelvic CT	10–50
• Abdomen and pelvis	13–25
• Aortic angiography of chest, abdomen, pelvis with or without contrast agent	6.7–56
• Coronary artery angiography	0.1–3
• Nonenhanced CT of abdomen and pelvis to evaluate for nephrolithiasis	10–11

CT computed tomography, *V/Q* ventilation/perfusion
[a]Fetal dose varies with gestational age, maternal body habitus, and exact acquisition parameters
[b]Most authors report fetal dose from the head, neck, or extremity CT close to zero (negligible scatter)

Uterine Rupture

Uterine rupture is rare, estimated to complicate only 0.6% of traumatic injury [48]. Risk factors include multiparty, prior uterine surgery, polyhydramnios, and multiple gestations [49, 56]. Fetal mortality approaches 100% and maternal mortality 10% [27]. A loss of palpable uterine contour as well as palpation fetal parts may be found on physical exam, and ultrasound may show abnormal fetal location.

Amniotic Fluid Embolism

Amniotic fluid emboli may occur in the setting of even minor trauma including all types of blunt trauma injuries [10, 57]. Symptoms are rapidly progressive and include disseminated intravascular coagulation, acute respiratory failure, and

cardiac arrest. Treatment is largely supportive. Pulmonary vasodilators such as inhaled nitric oxide, sildenafil, and prostacyclin may have theoretical benefit in moving the emboli through the lungs, but lack any significant evidence [10].

CardioPulmonary Arrest and Perimortem Cesarean Delivery

In the event of acute cardiopulmonary arrest in the pregnant patient whose uterus extends beyond the umbilicus, maternal survival requires uterine-aortocaval decompression. This may be accomplished by performing a perimortem cesarean delivery (PMCD). Delivery of the fetus aides in maternal survival by decreasing aortocaval compression, increasing venous return to the heart, and increasing cardiac output by 60–80% [58]. Indeed, some authors advocate using the term "resuscitative hysterotomy" to describe the procedure to emphasize the maternal benefits [59]. The most experienced physician should perform PMCD, and cardiopulmonary resuscitation (CPR) should be continued during the procedure. Obtaining fetal heart tones is not required prior to performing a PMCD. Ideally, the fetus should be delivered within 4–5 min from the initiation of CPR, although there are reports of positive maternal and fetal outcomes beyond this recommendation [60]. Favorable fetal-maternal outcomes are linked to earlier PMCD; however, the procedure is often unnecessarily delayed. The placenta must be removed from the uterus following delivery of the infant to maximize cardiac output. Closure of the uterus, fascia, peritoneum, and skin may be delayed until the return of spontaneous circulation is achieved [2]. Fear of litigation may hinder the clinician from performing a PMCD; however, there are no reported cases of litigation against an emergency physician for having performed a PMCD.

Disposition

Fetal compromise may not be apparent during the initial evaluation in the ED. Continuous cardiotocodynamometry should be performed in pregnant trauma patients presenting ≥24-week gestation for at least 4 h following even minor trauma [26]. If there is any question of fetal viability, the clinician should err on the side of performing continuous fetal heart monitoring until dates can be confirmed by ultrasound or other techniques [30]. In the event that there is no supportive obstetric care on-site, the patient should be transferred to a facility capable of providing continuous cardiotocodynamic monitoring and obstetric intervention. Criteria for admission and operative indications are otherwise similar for pregnant and nonpregnant trauma patients.

Summary

Trauma in pregnancy is a critically important topic for the emergency physician. It is the unique situation of caring for two patients simultaneously. Efficient and vigilant care of the mother takes precedence and generally ensures better outcomes for

both mother and fetus. Motor vehicle collisions, intimate partner violence, and falls are the most common mechanisms of trauma encountered. The emergency physician should seek to have a firm understanding of the specific anatomical and physiological changes of the pregnant patient as outlined above to ensure optimum care for their patients. The care of a pregnant patient in a trauma situation should include a multidisciplinary approach involving trauma surgeons and obstetricians early in the resuscitation. Emergency physicians are encouraged to err on the side of continuous monitoring or transfer to a facility capable of such in the event of a viable fetus with concern or question of potential injury.

Key Points

- The mother takes priority during the trauma resuscitation.
- A pregnancy test should be obtained in all female trauma patients of childbearing age.
- Motor vehicle collisions, intimate partner violence, and falls represent the majority of non-obstetric fatalities during pregnancy.
- Unrestrained pregnant women have higher rates of complications including preterm labor and fetal death. Emergency physicians should educate pregnant patients about appropriate use of three-point restraint.
- Relative tachycardia, hypotension, and tachypnea make it more difficult to identify hemodynamic instability early.
- Perimortem cesarean delivery should be performed within 4 min of initiation of CPR when possible.
- Pregnant patients with a viable fetus should have continuous cardiotocodynamic monitoring for at least 4 h following even minor trauma.

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