TRAUMA TO PREGNANT PATIENTS

Objectives:

At the completion of this packet the learner will:

1. Identify the major structures of the female reproductive system
2. Discuss the emergency medical care of a patient with a pre-delivery obstetrical emergency
3. Discuss miscarriage and the emergency medical care of the patient.
4. Discuss seizure in a pregnant patient the causes and treatment.
5. Discuss ectopic pregnancy and the treatment of the patient.
6. Discuss trauma to a pregnant patient and the complication which accompany.
7. Discuss the different types of trauma which may be encountered
8. Discuss the primary and secondary survey of a trauma patient.
9. Discuss domestic violence to a pregnant female.
10. Discuss the effect of trauma on a pregnant female patient.
The female reproductive system

It is important to have an understanding of the female reproductive anatomy in order to understand obstetrical and gynecological emergencies. The most important female reproductive organs are internal and located in the pelvic cavity. The reproductive system enables a woman to produce eggs, have sexual intercourse, nourish and house a developing fetus, and give birth.

Basic Anatomy

Ovaries: The ovaries are the female gonads, or sex glands. They are a pair of walnut-sized glands located on each side of the uterus in the upper pelvic cavity. The ovaries have two primary functions - to develop and release ova (eggs) for reproduction and to secrete the hormones estrogen and progesterone.

Fallopian Tubes: The fallopian tubes are a pair of muscular tubes that connect the ovaries to the uterus. The tubes provide a passageway for the transport of sperm to the ova and transport the ova back to the uterus.

Uterus: The uterus, or womb, houses the fetus during pregnancy. It is shaped like an inverted pear and is approximately three inches long and two inches wide. It is a muscular, expandable organ and is responsible for contractions during labor, ultimately helping to push the infant through the birth canal. The inner lining of the uterus, the endometrium, serves as the site of implantation of the fertilized egg, as well as the organ of menstruation.

Cervix: The cervix is the narrow portion of the uterus that opens into the vagina. During labor, the cervix will thin out, or efface, and dilate to allow the fetus and placenta to pass into the birth canal.

Vagina: The vagina, or birth canal, is the passageway between the uterus and the external genitalia or perineum. It is a three to six inch long tube with muscular walls lined with mucous membrane. It is the female organ of copulation and provides a passageway for menstrual flow and the fetus and placenta during delivery.

Perineum: The perineum is the area of skin between the vagina and the anus. During birth, as the infant moves through the birth canal, the perineum will begin to bulge significantly. This skin tears commonly during delivery.
During pregnancy, certain organs or structures develop that are not present in the non-pregnant state:

**Fetus:** The fetus is the developing, unborn baby.

**Placenta:** The developing fetus receives nourishment from the placenta, a spongy, disk-shaped organ that develops and attaches to the inner lining of the uterus during pregnancy. The placenta is responsible for exchanging nourishment and oxygen from mother to baby, transferring waste products from baby to mother, and manufacturing hormones vital to the maintenance of the pregnancy. The fetus is connected to the placenta by the umbilical cord. After the baby is delivered, the placenta, or afterbirth, separates from the uterus and is delivered. The placenta is sometimes referred to as the afterbirth.

**Umbilical cord:** The umbilical cord connects the fetus and the placenta. The umbilical cord contains two arteries and one vein, providing continuous blood flow from mother to fetus and from fetus to mother. The blood, oxygen, and nourishment to the baby from the mother are carried via the umbilical cord vein. The arteries carry deoxygenated blood, carbon dioxide, and waste products from the fetus back to the placenta. This process occurs without the blood of the mother and the blood of the fetus mixing.

**Amniotic sac (bag of water):** The amniotic sac surrounds the fetus inside the uterus. The sac contains 500 to 1000 mL of amniotic fluid. The sac and fluid insulate and protect the fetus while in the uterus.

**Physiology**

Sexual reproduction is the fertilization of a female gamete, the egg, by a male gamete, the sperm. When a female is born, her ovaries contain hundreds of thousands of eggs. These eggs remain dormant until adolescence, when the pituitary gland secretes hormones that stimulate the ovaries to produce the female sex hormones and help the female develop into a sexually mature woman. The onset of menstruation is also known as menarche. In the United States, the average age a girl starts menstruating is 12. However, this does not mean that all girls start at the same age. A girl can begin menstruating anytime between the ages of 8 and 16. Menstruation will not occur until all parts of a girl's reproductive system have matured and are working together.
The Menstrual Cycle
Menstruation is part of the menstrual cycle, which helps a woman's body prepare for the possibility of pregnancy each month. A cycle starts on the first day of a period. The average menstrual cycle is 28 days long. However, a cycle can range anywhere from 23 days to 35 days. Hormones rise and fall during the month and make the menstrual cycle happen. The ovaries produce two important female hormones, estrogen and progesterone. Other hormones involved in the menstrual cycle include follicle-stimulating hormone (FSH) and luteinizing hormone (LH), made by the pituitary gland.
In the first half of the menstrual cycle, levels of estrogen rise and make the lining of the uterus grow and thicken. In response to follicle-stimulating hormone, an ovum in one of the ovaries starts to mature. At about day 14 of a typical 28-day cycle, in response to a surge of luteinizing hormone, the egg leaves the ovary. This is called ovulation.
In the second half of the menstrual cycle, the egg begins to travel through the fallopian tube to the uterus. Progesterone levels rise and help prepare the uterine lining for pregnancy. If the egg becomes fertilized by a sperm cell and attaches itself to the uterine wall, the woman becomes pregnant. If the egg is not fertilized, it either dissolves or is absorbed into the body. If pregnancy does not occur, estrogen and progesterone levels drop, and the thickened lining of the uterus is shed during the menstrual period.

Menopause
Women usually continue having periods until menopause, which generally occurs sometime after a woman turns 50. Menopause means that a woman is no longer ovulating (producing eggs) and therefore can no longer become pregnant. Like menstruation, the onset of menopause can vary from woman to woman and may take several years to occur. Some women have early menopause because of surgery or other treatments, illnesses, or other reasons.

Pregnancy
A full-term pregnancy is from 38-40 weeks, when counting from the first day of the last menstrual cycle. The pregnancy is divided into 3 trimesters of about 3 months each. Deliveries before 37 weeks are considered premature. Toward the end of the third trimester, the head
of the fetus normally descends through the broad upper inlet of the mother's pelvis, positioning itself for delivery.

There are several emergencies that may occur during pregnancy:
Miscarriage (spontaneous abortion)
Seizures during pregnancy
Vaginal bleeding
Trauma during pregnancy

Miscarriage (Spontaneous Abortion)
A miscarriage, or spontaneous abortion, is the delivery of the fetus early in the pregnancy, before the fetus is able to survive outside the womb. Most miscarriages occur in the first 12 weeks of pregnancy, also known as the first trimester. Symptoms of miscarriage include vaginal bleeding, sometimes accompanied by menstrual-like cramps or more severe abdominal pain. While many women experience spotting in early pregnancy and most do not miscarry, a pregnant woman who experiences any bleeding, even light spotting, should be seen by a doctor.

Emergency Care:
To care for a patient with the signs and symptoms of a miscarriage:

- Perform initial assessment.
- Complete history and physical exam.
- Assess baseline vital signs.
- Apply oxygen and treat for shock.
- Provide treatment based on signs and symptoms.
- Apply external vaginal pads to absorb blood. Do not pack the vagina.
- Bring fetal tissues that have been expelled to the hospital.
- Provide emotional support to parents.

Seizures During Pregnancy
A seizure is a sudden attack, spasm, or convulsion that is a symptom of abnormal brain function. Seizure in pregnancy may occur because of pregnancy related conditions, such as eclampsia, or because of non-pregnancy related conditions such as epilepsy or hypoglycemia.
Preeclampsia is a condition that occurs in about 5% women during the second half of pregnancy. Signs and symptoms of preeclampsia include high blood pressure, protein in the urine, swelling (edema) of the hands and face, headache, and excess weight gain. If left untreated, eclampsia can develop. Eclampsia is a life-threatening condition that causes convulsions and coma. About 1 in 200 women who have preeclampsia will develop eclampsia.

**Emergency Care**

To care for a patient with the signs and symptoms of a seizure during pregnancy:

- Perform initial assessment.
- Complete history and physical exam.
- Assess baseline vital signs.
- Provide treatment based on signs and symptoms.
- Transport patient to the hospital positioned on her left side.

**Vaginal Bleeding**

Vaginal bleeding during pregnancy can indicate different conditions depending on the stage of the pregnancy. Early in the pregnancy, vaginal bleeding may indicate miscarriage or an ectopic pregnancy. Later in the pregnancy, bleeding may indicate problems with the placenta (*abruptio placenta* -placental bleeding late in pregnancy). In all cases, vaginal bleeding during pregnancy is a serious sign and the patient should be transported to the hospital for evaluation promptly.

**Emergency Care:**

To care for a patient with vaginal bleeding during pregnancy:

- Size up the scene.
- Perform initial assessment.
- Complete history and physical exam.
- Assess baseline vital signs.
- Apply oxygen and treat for shock.
- Provide treatment based on signs and symptoms.
- Apply external vaginal pads to absorb blood. Do not pack the vagina.
- Transport patient to the hospital promptly.
**Ectopic Pregnancy**

Ectopic pregnancy occurs when a fertilized egg is abnormally implanted outside the uterus, usually in the fallopian tubes (95%). When the fetus grows large enough, it ruptures the fallopian tube, causing internal bleeding. With any woman of childbearing age with lower abdominal pain, assume she is experiencing an ectopic pregnancy.

Symptoms include:
- Sharp pain in the lower abdomen.
- Pain can refer to the shoulder.
- Abdominal rigidity.
- Vaginal bleeding.
- Due to the severity of internal bleeding, shock may result.
- Ectopic pregnancy presents a significant threat to the mother.

**Emergency Care**

- Transport the patient immediately.
- Give oxygen.
- Start an IV line.

**Trauma**

Trauma resulting from a motor vehicle accident, a fall, or physical abuse can occur to anyone, but is especially dangerous to a pregnant woman and her fetus. While care for a pregnant woman with the signs and symptoms of trauma is generally the same as other trauma patients, there are some special considerations.

Shock can be difficult to detect in a pregnant woman because of the physiological changes that occur during pregnancy, such as increased blood volume and increased heart rate. When a pregnant woman loses blood, her body compensates by decreasing blood flow to the fetus. By the time overt signs of shock develop, the fetus may have already been harmed.

Pregnant patients should be transported on their left side. The inferior vena cava runs along the right side of the spine. A fetus can compress this vein, decreasing blood flow to the heart and reducing the patient's blood pressure. Transporting the patient on her left side can eliminate this complication. If the mother must be immobilized, immobilize on a spine board and place
padding under the right side of the board, which causes a shift to the left but maintains immobilization.

Finally, remember to provide emotional support to the mother since she will be worried about the health and safety of her unborn child.

**Emergency Care:**

To care for a patient with the signs and symptoms of trauma during pregnancy:

- Size up the scene.
- Perform initial assessment.
- Complete history and physical exam.
- Assess baseline vital signs.
- Provide treatment based on signs and symptoms.
- Transport patient to the hospital positioned on her left side.

**Trauma**

Trauma to the external genitalia can result in profuse bleeding and severe pain. You should treat these injuries as you would other bleeding soft tissue injuries.

- Take body substance isolation (BSI) precautions.
- Maintain airway.
- Administer oxygen.
- Perform on-going patient assessment.
- Provide emotional support and protect the patient's modesty.
- **Never pack vagina.**
- Treat for shock and transport immediately.

**Ruptured Ovarian Cyst**

In some cases, cysts (fluid-filled sacs) will grow in the ovary. These cysts can rupture, causing spillage of blood into the peritoneal cavity, causing abdominal pain and rebound tenderness.
Symptoms
In the prehospital environment, the patient will likely show the following signs of a ruptured ovarian cyst:

- Unilateral abdominal pain
- May radiate to the back
- Unilateral abdominal tenderness
- Pallor
- Tachycardia
- Hypotension
- Diaphoresis (perspiration)
- Vaginal bleeding

History
Patient may also complain of having had any of the following problems:

- Dyspareunia
- Erratic menstrual cycle
- Ongoing pelvic pain

Management

- Provide high-concentration oxygen
- Administer IV of lactated Ringer's solution
- Provide rapid transport

Domestic violence

Pregnancy can be an especially vulnerable period for women who suffer intimate partner violence. Studies estimate that up to 9% of women suffer physical or sexual violence by a male partner -- and between 40% and 59% of those women continue to experience intimate partner violence once they become pregnant.

Physical and sexual violence during pregnancy threatens both maternal and child health because it is often chronic and ongoing; more than 80% of women who suffer intimate partner violence
during pregnancy have been prior victims of partner abuse, according to background provided by Leone and colleagues.

Intimate partner violence during pregnancy is associated with adverse pregnancy outcomes including preterm birth and having a low birthweight baby, as well as increased risk of cesarean delivery, uterine rupture, hemorrhage and antenatal hospitalization.

Intimate partner violence also is linked with higher rates of maternal morbidity, including low weight gain, anemia, kidney infections, and first- and second-trimester bleeding, as well as depression and other psychological problems.

Placental abruption accounts for approximately 12% of perinatal deaths and has been discussed as a potential consequence of intimate partner violence, but evidence linking the two is sparse, Leone and colleagues wrote. Some risk factors for placental abruption are only indirectly associated with intimate partner violence.

Severe maternal injury is likely to lead to fetal loss in 40%-50% of cases, but severe maternal injuries are relatively rare. Minor injuries to the mother result from 88% of trauma in pregnancy; 60%-70% of fetal losses resulting from maternal trauma follow relatively minor maternal injuries, said Dr. Barsan, professor and chair of emergency medicine at the University of Michigan, Ann Arbor.

Placental abruption is the cause of fetal death in 50%-70% of losses after maternal trauma. "This is the one that may occur with relatively minor trauma" and can be hard to detect.

In one study of nine fetal deaths after 25-mph motor vehicle crashes in which the mothers were not wearing seat belts, six of the women sustained only "insignificant" injures, such as bruising or abrasions.

A separate study of 22 fetal deaths resulting from motor vehicle crashes found that six mothers sustained no injuries at all, and nine had bruised abdomens. Other maternal injuries included three ruptured uteri, two chest injuries, one extremity fracture, and one head injury with shock.
Perform electronic fetal monitoring for 4 hours on any pregnant woman with a viable fetus who sustains a significant impact to the torso from falling, crashing, or other causes. In one study, all patients with placental abruption after trauma developed uterine contractions every 2-5 minutes at some point during a 4-hour monitoring period.

Many women will have uterine contractions after trauma, and most will not have placental abruption.

**The effect of trauma**

The effect of trauma on pregnancy depends on the gestational age of the fetus, the type and severity of the trauma, and the extent of disruption of normal uterine and fetal physiology. The survival of the fetus depends on adequate uterine perfusion and delivery of oxygen. The uterine circulation has no autoregulation which implies that uterine blood flow is related directly to maternal systemic blood pressure, at least until the mother approaches hypovolemic shock. At that point, peripheral vasoconstriction will further compromise uterine perfusion. Once obvious shock develops in the mother, the chances of saving the fetus are about 20%.

If fetal oxygenation or perfusion are compromised by trauma, the response of the fetus may include bradycardia or tachycardia, a decrease in the baseline variability of the heart rate, the absence of normal accelerations in the heart rate, or recurrent decelerations. It should be noted that an abnormal fetal heart rate may be the first indication of an important disruption in fetal homeostasis. During trauma resuscitation, evaluation of the fetus should begin with auscultation of heart tones and continuous recording of the heart rate.

Trauma to the uterus (direct or indirect) can also injure the myometrium and destabilize decidual lysosomes, releasing arachidonic acid that can cause uterine contractions, and perhaps inducing premature labor.

**Maternal Physiology**

Increases in cardiac output and blood volume begin early in the first trimester and are 30-40% above the nonpregnant state by 28 weeks. This relative hypervolemic state and hemodilution is protective for the mother because fewer red blood cells are lost during hemorrhage. The
hypervolemia prepares the mother for the blood loss that accompanies vaginal delivery (500 ml) or cesarean section (1000 ml). However, almost 40% of maternal blood volume may be lost prior to the manifestation of signs of maternal shock.

Despite the increase in blood volume and cardiac output, the parturient is susceptible to hypotension from aortocaval compression in the supine position. Only about 10% of pregnant patients at term develop symptoms of shock in the supine position, but fetal compromise can be occurring even in the asymptomatic mother. Left uterine displacement increases cardiac output by 30% and restores circulation. Uterine displacement must be maintained at all times during resuscitation, transport and perioperatively for nonobstetrical surgery.

As the uterus enlarges, the diaphragm rises about 4 cm and the diameter of the chest enlarges by 2 cm, increasing the substernal angle by 50%. Care should be taken to consider these anatomic changes when thoracic procedures such as thoracostomies are being performed. The most important respiratory change during pregnancy is the decrease in functional residual capacity (FRC). Beginning in the second trimester, there is a 20% decrease in FRC coupled with a 20% increase in oxygen consumption. In addition, 30% of parturients have airway closure during normal tidal ventilation in the supine position. All these changes predispose to rapid falls in PaO2 during periods of apnea or airway obstruction. Hence, supplemental oxygen is always indicated for these patients in the resuscitation room. Minute ventilation increases at term by 50% due to an increase in tidal volume, so normal PaCO2 falls to 30-32 mmHg with a slight compensatory decrease in plasma bicarbonate levels.

Increased levels of progesterone and estrogen inhibit gastrointestinal motility. In addition, there is a decrease competency of the gastroesophageal sphincter, which increases the potential for aspiration. As the uterus enlarges, it displaces the intestines upward and laterally, stretching the peritoneum and making the abdominal physical examination unreliable.

To accommodate both maternal and fetal metabolic and circulatory requirements, renal blood flow increases by 25 to 50% during gestation. Blood urea nitrogen (BUN) and serum creatinine are reduced. Also, the kidneys enlarge by hypertrophy and hyperemia as early as the 10th week of gestation secondary to hormonal and mechanical factors.
The neurologic changes of pregnancy include a 25 to 40% decrease in anesthetic requirements. This means that loss of consciousness can occur even at "sedative" doses.

**General Approach to the Trauma Patient**

The primary initial goal in treating a pregnant trauma victim is to stabilize the mother's condition. The priorities for treatment of an injured pregnant patient remain the same as those for the nonpregnant patient.

**Primary Survey**

As with any other injured patient, the primary survey of the injured pregnant patient addresses the airway/cervical spine control, breathing and circulation (ABC; volume replacement/hemorrhage control), with the mother receiving treatment priority. Supplemental oxygen is essential to prevent maternal and fetal hypoxia. Severe trauma stimulates maternal catecholamine release, which causes uteroplacental vasoconstriction and compromised fetal circulation. Prevention of aortocaval compression is also essential to optimize maternal and fetal hemodynamics. Pregnant patients beyond 20 weeks’ gestation should not be left supine during the initial assessment. Left uterine displacement should be used by tilting the backboard to the left or as a final measure, the uterus can be manually displaced.

Hypovolemia should be suspected before it becomes apparent because of the relative pregnancy induced hypervolemia and hemodilution that may mask significant blood losses. Aggressive volume resuscitation is encouraged even for normotensive patients. The pneumatic antishock garment (PASG) may be used to stabilize lower extremity fractures and perhaps control hemorrhage. In the pregnant patient, inflation of the abdominal compartment of the PASG should be avoided because if compromises uteroplacental blood flow.

**Secondary Survey**

The secondary survey consists of obtaining a complete history, including an obstetrical history, performing a physical examination, and evaluating and monitoring the fetus. The obstetrical history is important because the identification of comorbid factors may alter management decisions. A history of preterm labor or placental abruption puts the patient at increased risk for the recurrence of the condition. The obstetrical history should include the date of the last
menstruation, expected date of delivery and any problems or complications of the current and previous pregnancies. Determination of the uterine size provides an approximation of gestational age, i.e. measurement of fundal height is a rapid method for estimating fetal age. Determination of fetal age and hence of fetal maturity is an important factor in the decision approach regarding early delivery.

The fetus is usually considered viable when it has a 50% chance of extrauterine survival. If neonatal facilities are available, this usually means at 25 to 26 weeks' gestation or an estimated weight of 750 g. More aggressive institutions use 24 weeks' gestation or an estimated weight of 500 to 600 g as the cut-off point, although chances of survival are then reduced to 20 to 30%. It should be noted that, even with the best of ultrasound dating criteria, unless the time of conception is known exactly, the assignment of gestational age is subject to 1 to 2 weeks of uncertainty. Decisions on fetal viability are made on the basis of the best gestational age available. When estimating the fetal age in the resuscitation area, a rough guide might be that when the fundus of the uterus extends beyond the umbilicus, the fetus is potentially viable.

Pelvic and rectal examinations should be performed. Aside from the usual secondary survey, assessment of the injured pregnant patient should rule out vaginal bleeding, ruptured membranes, a bulging perineum, the presence of contractions, and an abnormal fetal heart rate and rhythm.

Fetomaternal hemorrhage (FMH), the transplacental hemorrhage of fetal blood into the normally separate maternal circulation, is a unique complication of trauma during pregnancy. The reported incidence of FMH after trauma is 8 to 30%. There is no real correlation between severity of trauma, gestational age and frequency and volume of FMH. Complications of FMH include Rh sensitization in the mother, fetal anemia, fetal paroxystic atrial tachycardia or fetal death from exsanguination. In theory, FMH is possible by the 4th week of gestation; some say that FMH becomes a concern after 12 weeks gestation when the uterus rises above the pelvis and becomes an organ susceptible to direct trauma. FMH is detected by the Kleihauer-Betke (KB) acid elution technique on maternal blood. Upon examination, adult cells remain colorless while fetal red cells turn bright purple-pink. The ratio of fetal cells to maternal cells is recorded, enabling calculation of the volume of fetal blood leaked into the maternal circulation:
Most clinical laboratories will screen 1000 red blood cells taken from the mother. A maternal blood volume of 5 liters is commonly assumed in laboratory formulas so that one fetal cell per 1000 cells counted corresponds to a FMH of 5 ml. Unfortunately, the amount of FMH sufficient to sensitize most Rh-negative women is well below the 5-ml sensitivity level of the typical laboratory's KB test. As little as 1 ml of Rh-positive blood can sensitize 70% of Rh-negative women. Currently, several commercial kits expedite and simplify the test process. Unfortunately, the sensitivity of all the KB test is relatively low. Therefore, all Rh-negative mothers who present with a history of abdominal trauma should receive one 300-ug prophylactic dose of Rh immune globulin (anti-D immunoglobulin; Rhogam) within 72 hours of the traumatic event. Although controversial, we believe that the KB test should be reserved for Rh-negative women who are at risk for massive FMH that will exceed the efficacy of one dose of immune globulin, i.e. more than 30 ml. According to some studies, fewer than 1% of all trauma cases and only 3.1% of major trauma cases exceed the coverage of one 300-ug Rh immune globulin dose. As a general rule, 300 ug of Rh immune globulin should be given for every 30 ml of fetal blood found in the maternal circulation. The KB test is probably unnecessary before 16 weeks' gestation because the fetal blood volume is below 30 ml before this gestational age. For cases of documented FMH, some studies recommend repeating the KB test in 24 hours to check for increased bleeding.

**Fetal Assessment**

Fetal evaluation begins with checking fetal heart rate and noting fetal movement. Fetal heart tones can be detected by auscultation or doppler probe. This should be done early in the secondary survey and repeated frequently. The normal range for the fetal heart rate is 120 to 160 beats/minute. Continuous electronic fetal heart-rate monitoring (EFM) remains the most widely used modality for evaluation of the fetus, and is an adjunct to the monitoring of the maternal condition. The use of EFM permits prompt identification of the fetus at great risk for asphyxia and fetal death. Any viable fetus of 24 or more weeks' gestation requires monitoring after a trauma event. This includes patients with no obvious signs of abdominal injury because direct impact is not necessary for fetoplacental pathology to be present.

Controversy exists concerning the duration of fetal monitoring following a traumatic event to identify potential trauma-related fetal problems. The objective of the monitoring period is to
identify premature labor, abruptio placenta and fetal distress. The combination of high-resolution real-time ultrasonography and cardiotocographic monitoring seems to have the highest sensitivity and specificity. They should both be instituted as soon as feasible without interfering with maternal resuscitative efforts.

The most common obstetric problem caused by trauma is uterine contractions. Myometrial and decidual cells, damaged by contusion or placental separation, release prostaglandins that stimulate uterine contractions. Progression to labor depends upon the size of uterine damage, the amount of prostaglandins released, and the gestational age of the pregnancy. Some studies question the routine use of tocolytics for premature labor after trauma because the majority (90%) of contractions stop spontaneously and those contractions that are not self-limited are often pathological in origin, thus, contraindications to tocolytic therapy.

Placental abruption after trauma occurs in 2 to 4% of minor accidents and in up to 50% of major injuries. Separation results as the inelastic placenta shears away from the elastic uterus during sudden deformation of the uterus. Abruption can occur with little or no external signs of injury to the abdominal wall. Maternal mortality from abruption is less than 1%, but fetal death ranges from 20 to 35%. Clinical findings that indicate abruption include vaginal bleeding, abdominal cramps, uterine tenderness, amniotic fluid leakage, maternal hypovolemia, a uterus larger than normal for the gestational age, or a change in the fetal heart rate. When present after trauma, vaginal bleeding is a ominous sign often indicative of placental separation. The first-line test to try to confirm the presence of abruption is the transabdominal ultrasound. Unfortunately, it is less than 50% accurate. In general, cardiotocographic monitoring is more sensitive in picking up placental abruption by fetal distress than ultrasound is by visualization. Most cases of abruption become evident within several hours after trauma. Cardiotocographic monitoring should be started in the resuscitation room and continued for a minimum of 4 hours. A minimum of 24 hours of cardiotocographic monitoring is recommended for patients with frequent uterine activity (more than 6 contractions per hour), abdominal or uterine tenderness, ruptured membranes, vaginal bleeding, or hypotension. For patients without any of these signs or symptoms, normal findings on the cardiotocographic monitor for at least 4 hours duration and a normal ultrasound, discharge may be considered. Fetal distress is associated with placental abruption 60% of the time and immediate intervention is required.
In the trauma setting, ultrasound may help identify other problems related to the maternal event besides placental abruption such as cord prolapse and placenta previa. It is also routine to evaluate the fetus for gestational age, cardiac activity and movement. If time permits, a complete biophysical profile may be performed.

**Maternal Trauma During the First Trimester**

During the first trimester, the uterus is protected within the pelvic bones. Trauma during this time will either be so severe as to cause a miscarriage (spontaneous abortion or fetal death), or else it will have no effect.

Miscarriage is a common event, normally occurring in one out of every 5 or 6 pregnancies. While trauma can cause 1st trimester pregnancy loss, it is exceedingly rare in comparison with other causes of miscarriage.

Catastrophic trauma includes such types of injury as maternal death, hemorrhagic shock, multiple compound fractures of the extremities, liver and spleen ruptures, to name a few. Catastrophic trauma during the first trimester is often associated with subsequent miscarriage.

Non-catastrophic trauma includes bumps, bruises, fractures of small bones (fingers, toes), minor burns, etc. While such non-catastrophic injuries may be serious enough to require treatment, they are not associated with miscarriages.

**Maternal Trauma During the Second and Third Trimester**

Trauma occurring during the second and third trimester has different clinical consequences than during the first trimester. First trimester, minor trauma is not threatening to the pregnancy. During the second and third trimester, even relatively minor trauma can have significant adverse effects on the fetus. Such adverse effects include placental abruption, preterm labor, premature rupture of the membranes, uterine rupture, and direct fetal injury.

- Rapid acceleration, deceleration, or a direct blow to the pregnant abdomen can cause shearing of the placenta away from its’ underlying attachment to the uterus. When this happens (placental abruption), the detached area will bleed and the detached area of the placenta will no longer function to supply oxygen to the fetus. A complete abruption is a
disastrous event, life-threatening to both the fetus and the mother. Partial placental abruptions may range the full gamut from insignificant to the striking abnormalities seen in complete abruptions.

- Premature labor may be provoked. In these cases, regular uterine contractions begin shortly after the trauma (within 4 hours) and progress steadily and result in delivery. Premature rupture of the fetal membranes can also occur, within the first 4 hours of injury and usually result in a premature delivery.
- Direct fetal injury may occur, resulting in contusions, fractures or fetal death.
- Uterine rupture can occur and usually result in the loss of the fetus.

The severity of the maternal injury may not correlate well with the frequency of adverse pregnancy outcome. Even minor trauma can have very serious consequences for the pregnancy.

The adverse effects, when they occur, are immediate (within the first few days of the trauma). There is probably no increased risk of preterm delivery, depressed Apgar scores, cesarean section or neonatal length of stay, after excluding the following immediate adverse effects:

- Placental abruption within the first 72 hours of injury.
- Rupture of membranes within 4 hours of injury.
- Onset of labor within 4 hours of injury that resulted in delivery during the same hospitalization.
- Fetal death within 7 days of the traumatic event.

Uterine contractions following trauma are common, although premature delivery caused by preterm labor is not. Actual preterm delivery resulting from premature labor (in the absence of abruption) probably occurs no more frequently among traumatized women than the general population.

**Blunt Abdominal Trauma**

There are several important considerations when addressing blunt thoracoabdominal trauma in the pregnant patient. The physical examination may be unreliable because the enlarged uterus displaces the abdominal content and stretches the peritoneum thus perhaps diminishing the response to peritoneal irritation. The evaluation of possible injury to the abdomen is different
because of the presence of the gravid uterus. The preferred diagnostic modalities for evaluation
during the first trimester of pregnancy are ultrasound, diagnostic peritoneal lavage (DPL), and
CT-scan, in that order. Because the first trimester is the period of organogenesis, ultrasound is
preferable for the detection of hemoperitoneum. Because of its sensitivity, DPL can be used to
evaluate the abdomen using the supraumbilical, open technique to avoid injury to the gravid
uterus. The major disadvantage of DPL with respect to the pregnant patient is its invasiveness. If
CT-scan is necessary, both oral and intravenous contrast media should be administered. During
the second trimester, ultrasound or CT-scan may be used to evaluate the abdomen. DPL may be
difficult to perform because the enlarged uterus may interfere with the dependent catheter
position and return of fluid. On the other hand, several studies have shown its safety and
usefulness. During the third trimester, the injured pregnant patient can best be assessed by
ultrasound or CT-scan.

Although motor vehicle accidents are the most common cause of serious blunt trauma in
pregnancy, assaults, abuse and falls are frequent. In addition to maternal mortality from blunt
trauma, which is estimated to be about 7%, the fetus is at significant risk, especially if placental
abruption, placenta previa, or uterine rupture occur.

**Penetrating Thoracoabdominal Trauma**

As mentioned before, as pregnancy progresses, intra-abdominal organs change position, with
important implications (Figure 1). Because the bowel is pushed upward by the enlarged uterus,
penetrating injury to the upper part of the abdomen is more likely to be associated with multiple
gastrointestinal injuries. Organs involved in decreasing frequency are the small bowel, liver,
colon, and stomach. During the third trimester, injuries to the lower quadrants of the abdomen
almost exclusively involve the uterus. This may be advantageous to the mother because the
uterus and amniotic fluid absorb most of the energy of the missile, resulting in less destruction to
other organs. If the uterus is involved in penetrating trauma, fetal injury may occur in 60 to 90%
of cases. Gunshot wounds to the uterus carry a maternal mortality of 7 to 9% and a fetal
mortality of around 70%. Fetal mortality is higher if injury is caused before 37 weeks of
gestation.
When evaluating the pathway of a bullet, radiographs (anteroposterior and lateral views) of the chest and abdomen, with the entrance and the exit wounds marked with paper clips may help the physicians. Some controversy exits but the prevailing opinion at this time is that pregnant women with gunshot wounds to the abdomen should generally undergo mandatory celiotomy. Stab wounds to the abdomen are managed similarly in pregnant and nonpregnant patients if signs of obvious intra-abdominal injury are present (shock, peritoneal signs, evisceration) or positive investigation.

A midline celiotomy should be performed, with exploration as in the nonpregnant state. If extraterine intra-abdominal injuries are identified, organs are repaired or resected in the usual manner. Whenever the enlarged uterus interferes with adequate examination or repair, cesarean section is required. Celiotomy alone does not justify cesarean section because it prolongs the operation and increases blood loss by at least 1000 ml. Specific indications for cesarean section during celiotomy include maternal shock and pregnancy near term, threat to life from exsanguination from any cause, mechanical limitation for maternal repair, irreparable uterine injury, instability in a potentially viable fetus, unstable thoracolumbar spine injury, and maternal death.

**Burn Injury**

Treatment priorities are the same when managing pregnant and nonpregnant burn victims. Maintenance of a normal intravascular volume, avoidance of hypoxia, and prevention of infection are important. Burned areas of tissue should be debrided and cleaned. Silver sulfadiazine cream should be used sparingly because of the risk of kernicterus associated with sulfonamide absorption.

In cases of electrical burns, fetal mortality is high at 73% even with a rather low electrical current because of the fetus' lack of resistance to electrical shock. This is probably related to the fact that the fetus is floating in amniotic fluid with a low resistance to current. No matter how trivial their injury may seem, fetal monitoring and ultrasound assessment are indicated for all pregnant victims of electrical shock.
Perimortem Cesarean Delivery

During maternal resuscitation, adequate oxygenation, fluid loading, and left lateral decubitus should be tried to see if maternal circulation can be improved. Maternal survival after delivery of the fetus during unsuccessful cardiopulmonary resuscitation (CPR) has been reported. If there is no response to advanced cardiac life support within a few minutes (2 to 3 minutes), maternal cardiopulmonary resuscitation must be continued, anterior thoracotomy with open-chest cardiac massage (OCM) but without aortic cross-clamping should be considered, and emergency cesarean section for a viable fetus should be performed.

Studies have shown that conventional external cardiac massage (ECM) becomes less effective as the patient approaches term because of mechanical factors. The only method of assessing adequacy of fetal oxygenation during CPR is to monitor fetal heart rate (FHR). Carotid pulse and end-tidal CO2 monitoring should be used to monitor adequacy of maternal vital organ perfusion during CPR.

When the gestational age is less than 24 weeks, emergency cesarean delivery is usually not performed because the fetus is too small to survive and the birth is unlikely to have much effect on maternal hemodynamics. However, when gestational age is greater than 24-25 weeks, emergency cesarean birth probably will favorably affect maternal or fetal outcome. At a gestational age of 26 to 32 weeks, when external cardiac massage is not effective, as indicated by failure to generate a carotid pulse, inadequate end-tidal CO2 levels, or fetal bradycardia, OCM should be seriously considered before an emergency cesarean section is performed. If OCM prove successful, the delivery may be delayed so that chances of postnatal survival improve. Even slight prolongation of fetal intrauterine life will probably improve the chances of fetal survival, especially when gestational age is less than 28 weeks. If, however, OCM proves to be ineffective, the fetus must be delivered immediately. After 32 weeks gestation, when ECM is not effective, an emergency cesarean section must be performed immediately. Delivering the infant improves maternal cardiac filling, thereby improving the success of CPR. The longer the delay between the onset of cardiac arrest and delivery, the less are the chances of fetal and maternal survival. If, however, the ECM appears to be effective, ECM may be continued for 5 minutes. If a spontaneous circulation is not restored within 5 minutes, an emergency cesarean delivery must
be performed. If this fails to revive the mother, OCM may be considered. Ideally, personnel trained in neonatal resuscitation should be available to attend the infant.

Once you have finish with the study guide, just click on Start Exam to get going.

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