# Critical Care in OBSTETRICS

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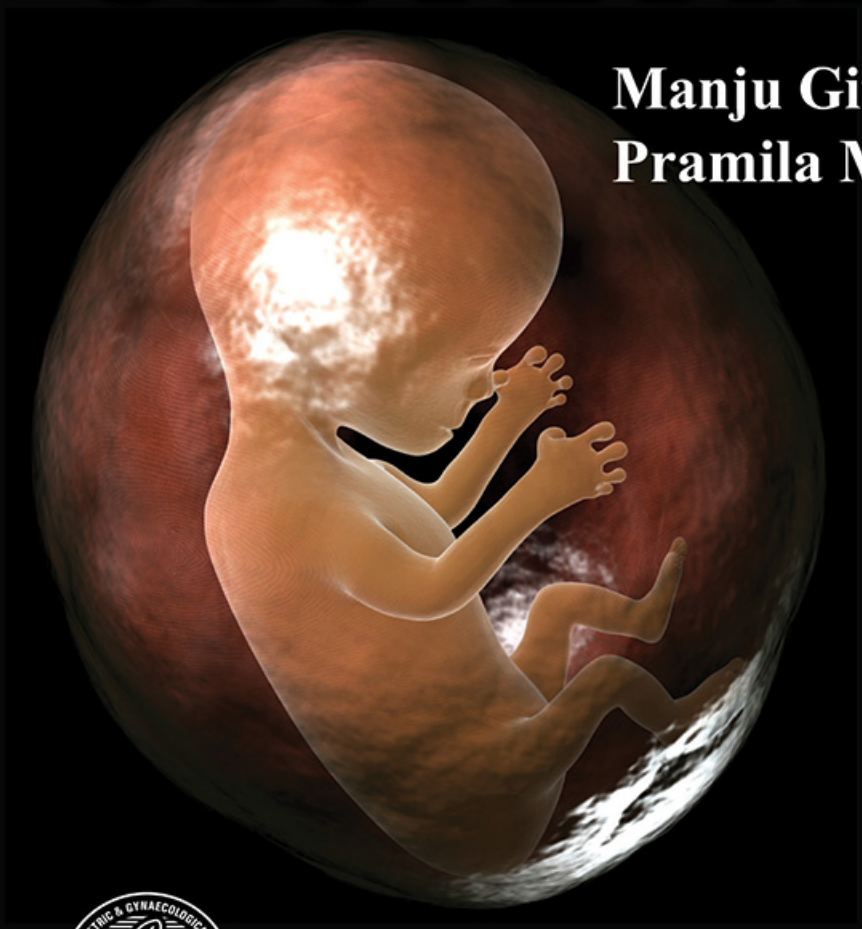
Pramila Modi



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JAYPEE

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# Chapter 4

# Trauma in Obstetrics

*Kusum Gopal Kapoor*

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## INTRODUCTION

A pregnant patient presenting with injury though not very common, it requires quick assessment and resuscitation. Trauma is the most important cause of non-obstetric death in pregnancy. Although maternal mortality due to other causes such as infection, hemorrhage, hypertension, and thromboembolism, has declined over the years, the number of maternal deaths due to penetrating trauma, suicide, and homicide and motor vehicle accidents has risen steadily.[1]

The approach to treating trauma is different in patients who are pregnant than in patients who are not pregnant. Unless the treating physician is aware of maternal physiologic adaptation to pregnancy, misdiagnosis and suboptimal treatment may ensue. On the other hand, a wide variety of obstetrical pathologies can obscure, and delay the diagnosis of intra-abdominal injury.

Accidental injuries occur in 6 to 7 percent of all pregnant patients. Penetrating trauma accounts for as many as 36 percent of maternal deaths. In the case of gunshot wounds to the pregnant abdomen, overall maternal mortality is low (3.9%). Fetal mortality, on the other hand, is high, ranging between 3.4 to 38 percent.[2]

Although the initial assessment and management priorities for resuscitation of the injured pregnant patient are the same as those for other traumatized patients, the specific anatomic and physiologic changes that occur during pregnancy may alter the response to injury and hence necessitate a modified approach to the resuscitation process. It is, therefore, imperative to understand the anatomic and physiological alterations in pregnancy to optimize maternal and fetal outcome. The main principle guiding therapy must be that resuscitating the mother will resuscitate the fetus.

The concern for the fetus adds to complexity of diagnosis and management of trauma during pregnancy. High flow oxygen must be routinely administered to any pregnant woman other than a trivial limb injury.

The pregnant patient can lose 35 percent of her blood volume before manifesting any of the classical sign and symptoms of shock.[3] Vigorous fluid infusion and early blood transfusion is required to avoid the attendant severe fetal compromise.

To treat pregnant patients in trauma it is essential to know the physiology of all the systems of body.

## PHYSIOLOGICAL CHANGES

### Cardiovascular Systems

The maternal cardiovascular system plays a key role in uteroplacental physiology. In the third trimester, maternal position has a great impact on intravascular pressures and cardiac output. In the supine position, the uterus obstructs both the inferior vena cava and the aorta. Venous pressures in the lower leg can be as high as 20–25 mm Hg, and the caliber of the aortic lumen is reduced by 40 percent. Cardiac output in the supine position subsequently may be reduced as much as 25 percent compared with that in the left recumbent position. A key component in the treatment of a critically ill trauma patient is to place the patient with a left pelvic tilt via a wedge. As a result of the increased blood volume, signs of significant blood loss like tachycardia and hypotension may not be evident in a pregnant woman until she has lost 30–35 percent of her blood volume.

### Respiratory Physiology

Hormonal and mechanical changes (e.g. enlarging uterus) combine to produce hyperventilation. Progesterone acts early to increase the respiratory rate by 15 percent. Minute ventilation and tidal volume are increased 50 percent and 40 percent, respectively. The relative hyperventilation is reflected by hypocapnia (i.e., $PaCO_2$ is 28–32 mm Hg). Anxiety and pain can cause a pregnant patient to increase her respiratory rate to the point of significant hypocapnia.

During pregnancy, the closing capacity is elevated in the first 48–72 hours after abdominal or thoracic surgery; the resultant arteriovenous shunting further hastens the onset of hypoxia.

### Renal Physiology

Changes in the cardiovascular system are reflected in the renal system. Pregnant women are more susceptible to symptomatic urinary tract infections. The risk may be related to increased urinary stasis, or urinary human chorionic gonadotropin may enhance the attachment of pathologic organisms to the urinary mucosa. Because women who experience trauma often have Foley's catheters, another risk factor for urinary tract infection, consider pyelonephritis when a trauma patient's fever spikes.

### Coagulation Physiology

Pulmonary embolism is a major cause of maternal death, and the pregnant (or immediately postpartum) woman is at increased risk. Obesity (i.e. body mass index (BMI) > 26) is an independent risk factor for deep venous thrombosis after trauma, and many women have a BMI greater than 26 in late pregnancy. In addition, changes in coagulation physiology place these patients at an even greater risk.

Infection, general anesthesia, and surgery further exaggerate the risk when the third component of Virchow triad, vascular injury, is added. Postoperative bed rest increases the risk of stasis. Prevention is the cornerstone of management. Once high-risk patients are identified, prophylactic heparin (5000–7500 U q8-12h), intermittent pressure stockings, and early ambulation constitute standard therapy.[5]

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## Gastrointestinal Physiology

Abdominal distention, with or without fluid, is best determined by the location of areas of dullness when the patient is turned from side to side. Peristaltic sounds characteristic of an obstruction are high-pitched, tinkling, and with rushes. Absence of peristalsis sounds is an important sign, often indicating an ileus or the presence of intraperitoneal fluid, pus, or blood. When intestinal obstruction is suspected, abdominal X-ray films (i.e. upright, flat plate, left lateral decubitus) are essential and should not be withheld for fear of fetal exposure to radiation.

Constipation is common in the pregnancy because of the effects of progesterone on bowel mobility and the widespread use of hematinic agents. The combination of bed rest, pregnancy, iron supplements, and narcotics for pain after trauma during pregnancy poses an important management problem. Routine use of bulk stool softeners is recommended.

Physiologic changes in the GI tract during pregnancy increase the risk of aspiration during surgery and anesthesia. When the patient is not allowed or cannot have oral intake, such as with prolonged ventilation, neurologic injury, and bowel injury, fetal intrauterine growth retardation may occur. If a patient has had insufficient intake (i.e. < 1500 kcal/d) for 72 hours, start parenteral nutrition.

Hyperglycemia can be a greater risk because pregnancy usually is a diabetogenic state. Mean glucose levels consistently greater than 105 mg/dl with insulin. The fetus is evaluated for growth and well-being. Nonstress tests are performed twice weekly, and serial ultrasonography for fetal growth should be obtained.

## Central Nervous System

Pregnancy critically changes the need for several anesthetic drugs. The requirement for halogenated anesthetics (i.e. halothane) is reduced by 40 percent because of the increased minute volume. The dose of epidural anesthetic agents is reduced by 50 percent. The uterine vasculature is sensitive to alpha-adrenergic stimulation. Maternal stress response, maternal anxiety, or alpha-adrenergic vasopressors can result in fetal hypoxia and acidosis.

**Injury in obstetrics** may be dealt as — injury to the mother, injury to the uterus, injury to the fetus.

## Injury to the Mother

This may be caused due to:

1. Road accident
2. Blunt and penetrating injury.

Minor blunt trauma is a common occurrence in pregnancy, and does not have any significant effect on perinatal mortality. Rarely, however, placental abruption may occur with trivial maternal injury. It is, therefore, preferable to do a nonstress test in all pregnant women, who report an injury or fall during pregnancy.

Knife and gunshot wounds are the most common penetrating injuries and may be associated with assault, suicide attempts, or attempt to cause abortion.

Injury may be perennial, valval, veginal, cervical and uterine. Injury of Viscera-spleen, bladder is common. Small bowel in upper abdominal trauma is injured frequently. Pelvic vessels are also common injury. Injury to lung causes increased risk of thrombo-embolism, lung atelectasis. Aspiration of gastric content also may

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occur. Organs of decreased risk of injury during pregnancy are pelvic fracture due to relaxation of the symphysis pubis and sacroliac joints, the increased vascular supply to the pelvic area means that intra-retroperitoneal bleeding may be catastrophic.

The veins of broad ligament may be damaged by blunt or penetrating trauma giving rise to hematoma, which may require bilateral internal iliac and ovarian vessel's ligation to control bleeding.

## Injury to Uterus and Fetus

Uterine rupture is less common than placental abruption (estimated at about 1 percent of severely injured pregnant woman). In the first trimester the uterus is protected by the bony pelvis and there is no well-validation evidence of fetal loss due to trauma in this group. As pregnancy progresses the uterus rises above the pelvic brim and becomes increasingly thin walled, the fetus is less cushioned by the amniotic fluid and the head becomes fixed in the pelvic brim by term. It, therefore, becomes steadily more vulnerable to both direct and indirect trauma. The fundal height should be marked on the abdominal wall as a guide to any abdominal wall as a guide to any increase in the uterine size (an indicator of placental abruption) the fetus should be monitored continuously.

Four factors in maternal trauma or surgery predict fetal morbidity and mortality—hypoxia, infection, drug effects, and preterm delivery. Fetal death can occur at any gestational age and usually results from fetal hypoxia.

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.[6] The survival of the fetus depends on adequate uterine perfusion and delivery of oxygen.

The most important surgical risk to the fetus is preterm delivery. Before 23 weeks gestation, preterm delivery uniformly results in neonatal death. After 28 weeks gestation,[7] intact survival rates improve more slowly. An infant born at term is better off than an infant born preterm. The key gestational age breakpoints in fetal outcome appear to be 25, 28, 32 and 36 weeks gestation. Birth at hospitals without expertise in high-risk obstetrics and neonatology is associated with a significantly higher risk of perinatal death and a doubling or tripling of long-term handicap. Taking into consideration the transport time, resources, and maternal condition, in-utero transport is preferable to delivery and neonatal transport in most cases.

The most likely cause of preterm labor in a trauma patient is abruptio placentae; however, other etiologies are possible and must be considered. Preterm labor may be the cause of abdominal pain or a consequence of non-obstetric disease, trauma, or infection. However, the intrauterine environment may not be ideal, and the treatment of preterm labor may exacerbate the effects of intra-abdominal disease. Before making a definitive diagnosis, consider the many obstetric conditions that pose greater fetal risk (e.g. Chorioamnionitis, abruptio placentae). These often mimic acute non-obstetric conditions.

Once the diagnostic test or surgery has been performed and the mother's cardiovascular status is stable, the decision of whether or not to inhibit labor can be made. Magnesium sulfate is the therapy of choice. The dose is 4 g in 250 ml of isotonic sodium chloride administered intravenously during a period of 15 minutes, followed by 2 g/h by electronically monitored intravenous drip. Monitor the fetus continuously throughout diagnosis and management.

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Tocolysis in the presence of these diseases is not indicated. The cardiovascular effects of beta-adrenergic drugs (e.g. Terbutaline, ritodrine) can exacerbate those of sepsis (e.g. Vasodilatation, shock). For example, intravenous ritodrine poses a 5–10 percent risk of serious cardiopulmonary complications, such as pulmonary edema and significant subendocardial ischemia. Amniocentesis under ultrasonographic guidance has many advantages. Bacteria or sheets of leukocytes on a high-power microscopic examination of an unspun specimen suggest chorioamnionitis. If peritonitis is present, amniotic fluid contamination is a special concern. In the presence of peritonitis, do not allow amniocentesis to delay an exploratory laparotomy.

Direct injury to the fetus from blunt trauma is rare, the most common being skull fracture and intracranial hemorrhage. Extremely rarely placental or cord damage may be found often out of proportion to the severity of the maternal injury. Amniotic fluid embolism may be a rare consequence of trauma.

## 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 non-pregnant patient.

Despite the increase in blood volume and cardiac output, the parturient is susceptible to hypotension from aortocaval compression in the supine position. 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 percent. Care should be taken to consider these anatomic changes when thoracic procedures such as thoracostomies are being performed.

## Primary Care

As with any other injured patient, the primary survey of the injured pregnant patient addresses the airway I cervical spine control, breathing and circulation, 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 compromized 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.[8]

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.

Packed cells should be transfused as soon as they are available if there is appreciable blood loss, to prevent hypoxic injury to the fetus and the maternal kidney and other organs.

The large transfusion (i.e. 2–3 mL/1 mL blood loss) of crystalloid solutions in association with trauma or burns results in earlier onset of pulmonary edema in pregnant women and immediately postpartum.

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## Secondary Care

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 combined 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. Determination of the uterine size provides an approximation of gestational age; i.e. measurement of fetal 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. Decisions on fetal viability are made on the basis of the best gestational age available. 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.[9]

## Diagnostic Imaging

Ultrasonography is useful in assessing the fetal age, placental localization. Fetal heart rate and amniotic fluid, together with cardiotocography and ultrasound majority of the complications, can be diagnosed.

Radiological investigations in pregnancy usually raise concerns regarding the possible risks of exposure to the fetus. Most routine diagnostic radiographs do not result in significant exposure (chest and extremities- < 0.5 mrads, abdomen-220 mrads, lumbar spine-720 mrads, IVP mrads), and therefore, should not be withheld for fear of fetal radiation.[10]

## Electrical Injury

The effect of electrical shock on pregnancy outcome is controversial. Four reported cases in which the mother was struck by lightning, all pregnancies were lost either as abortion or still birth.[11] Electrical shocks resulting from home appliances at 110–220 volts, however, caused no adverse effect on the mother or the fetus. Electroconvulsive therapy during pregnancy in any trimester has been reported to have only transient and self-limiting effects on the fetus.

## Perimortem Cesarean Section

This procedure should be started if resuscitation was unsuccessful for a period of four minutes and the baby delivered in five minutes to maximize the chances of fetal survival without neurological sequelae. A return of maternal pulse and blood pressure is noted in several cases after emptying the uterus and may, therefore, benefit maternal resuscitation and survival. In a review of 38 perimortem cesarean section from 1985–2004, Katz et al[18] reported survival of 34 infants and 13 mothers. There was no deterioration in the maternal condition observed in any patient after the procedure.

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## CONCLUSION

Trauma has become the most frequent cause of maternal death. The main principle guiding therapy must be that resuscitating the mother will resuscitate the fetus. Late fetal loss of the babies occurs if the mother is suffering with anemia and hypoproteinemia.

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# Critical Care in OBSTETRICS

***Salient Features***

- A must for obstetricians
- Deals with all aspects of management of critically-ill pregnant women
- It also deals with care of fetus of a critically-ill gravida as well as care of baby born to critically-ill mother
- Focuses onto anesthetic management and ventilatory procedures
- Guides the practising obstetricians to cope up with life-endangering situations
- Addition of new chapters such as pregnancy with cancer, perimortem cesarean section and medicolegal aspects are thought-provoking aspects.



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