Emergency Delivery and Peripartum Emergencies

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PRESENTING SIGNS AND SYMPTOMS

Labor is classically heralded by shedding of the mucous plug that was occluding the cervix (the “bloody show”), passage of clear fluid from the vagina from ruptured membranes (the “water breaking”), and contractions. True contractions are organized and detectable by tocometry; tend to increase in pain, frequency, and strength with time; and have associated cervical changes. Braxton-Hicks contractions, commonly called false labor, are characterized by unorganized myometrial activity without cervical changes. Other common symptoms at labor onset include abdominal pain and back pain.

In the emergency department (ED), the majority of patients seen in labor are in the latter part of stage I or stage II. Pre-precipitous delivery is a common occurrence because most patients whose labor progresses more slowly will have time to get to their designated obstetric facility.

DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING

For any woman encountered after 20 weeks of pregnancy, labor must be in the differential diagnosis. Although the ultimate differentiation of false labor, or Braxton-Hicks contractions, is made by continuous tocometry, a good history can often make the diagnosis.

For patients with a chief complaint of vaginal bleeding, placental abruption and placenta previa should be considered. When the only complaint is passage of clear fluid from the vagina, premature rupture of membranes (PROM) and preterm premature rupture of membranes (PPROM) should be assumed until proved otherwise.

For an uncomplicated delivery, no diagnostic testing is needed. In those without any prenatal care, a complete blood count and Rh status should be obtained.

For patients complaining of vaginal bleeding, placenta previa or abruption should be assumed. Ultrasound is required to evaluate for previa. It is essential that placenta previa be diagnosed early because vaginal delivery is absolutely contraindicated with this condition. Ultrasound is not useful in ruling out the diagnosis of placental abruption because toco-cardiographic monitoring in an obstetric suite is required.

TREATMENT

The major point of triage is during stage I of labor. If care is available in-house, transfer can be accomplished at any point before crowning. If care requires out-of-hospital transfer, it is imperative to establish early and reliable contact with the treating obstetrician to facilitate a safe plan of care.

KEY POINTS

• If shoulder dystocia is encountered, attempt the McRoberts maneuver with suprapubic pressure while simultaneously calling for obstetric assistance.
• Practitioners underestimate blood loss in postpartum hemorrhage by as much as 50%.
• Uterine inversion is relatively uncommon but is associated with significant morbidity if not recognized and treated promptly.
• Up to 87% of patients with uterine rupture have no pain, and up to 89% have no vaginal bleeding.
• Perimortem cesarean delivery is indicated in gravid patients if more than 24 weeks pregnant and if arrest continues after 4 to 5 minutes of cardiopulmonary resuscitation.
• The clinical examination of a term pregnant patient is notoriously unreliable.
• Treatment of anaphylactoid syndrome of pregnancy is similar to that for sepsis and disseminated intravascular coagulation and should begin immediately; the diagnosis is one of exclusion, and patients must be treated promptly to survive.

EMERGENCY DELIVERY

PATHOPHYSIOLOGY

During labor the fetus follows a series of stereotypic movements known as the cardinal movements of labor. Although the specifics have little bearing on the emergency physician’s approach to labor, the final movement typically leaves the baby with the occiput anterior (relative to the maternal pelvis) and the head sharply flexed. This position offers the smallest fetal head diameter and is therefore optimal for passage through the pelvis. Any deviation from this position is by definition a malpresentation, and these different presentations are all associated with increasing morbidity and mortality. The overwhelming majority of births, however, will require little physician intervention beyond timely encouragement and vigilance for complications.

For a description of potential malpresentation, along with management recommendations, see www.expertconsult.com
Even though multiple physical interventions may be necessary with an abnormal delivery, an uncomplicated one typically only requires measures that support smooth fetal passage. Resuscitation equipment should be available immediately. Episiotomies are no longer recommended during routine pregnancies. They should be used sparingly and typically only with complicated deliveries. If shoulder dystocia is encountered, hyperflexion of the maternal hips and knees (McRoberts maneuver) and suprapubic pressure are first-line interventions that resolve most instances of dystocia.

For more information on the management of difficult labor, see www.expertconsult.com

After determination of hemodynamic stability, the next priorities are to determine whether true labor is occurring and the appropriate disposition to achieve optimal medical care. For any patient with a complaint of passage of clear fluid from the vagina without other signs and symptoms of labor (bloody show and regular, progressing, often painful contractions), a sterile speculum examination should be performed before a gloved digital examination to evaluate for PROM.

Once labor is confirmed, the goal is to evaluate the positioning (orientation in space relative to the maternal pelvis) and presentation (body part palpable at the cervix) of the fetus, along with the degree of change in the uterine cervix. This includes assessment of station (level of descent into the pelvis relative to the maternal ischial spines), effacement (degree of cervical thinning), and dilation of the cervical aperture. For the emergency physician, determination of dilation and effacement is the most important part of the examination—a fetus that is still contained within a closed and minimally effaced cervix will probably be transferred to obstetrics whether or not it is vertex (fetal head as the presenting part).

If delivery is imminent, the patient will have to remain in the ED. A gynecologic bed with lithotomy position capability is ideal, and a resuscitation bay with greater accessibility and equipment is recommended. A radiant warmer and appropriate airway equipment should be available. Positioning of the mother may require an approximate 10-degree tilt to the left to prevent uterine pressure on the inferior vena cava and associated hypotension. When crowning occurs, the mother should be instructed to push along with the contractions, with the physician positioned in front of the introitus ready to accept the fetus. As soon as the head is accessible, continuous gentle countertraction should be administered to maintain it in a flexed position. This technique provides control of an explosive delivery, as well as avoidance of the high morbidity associated with fetal neck hyperextension. Though once recommended, the modified Ritgen maneuver has recently been shown to be associated with an increased rate of third-degree lacerations and episiotomy in comparison with a “hands-off” approach. Similar rates of perineal tears were found for each modality.

When the head is clear, the fetus rotates 90 degrees. Suction of the fetal mouth and nose should be performed as soon as possible in the setting of meconium staining. Typically, the shoulders will then be delivered, anterior first, without assistance. Mild downward traction on the torso (not lateral flexion of the neck) may be required to assist passage of the anterior shoulder. Once clear, the posterior shoulder is typically delivered spontaneously or with upward traction in a similar manner as just described. At this point the largest fetal diameter has passed, and labor is generally smooth. The cord may be clamped once it is accessible after passage of the fetus. If the cord is tightly wound around the fetus, knotted, or abnormal in any way, it is clamped (typically at 7 and 10 cm) and cut once accessible. When free, the neonate is dried and warmed and its resuscitation needs evaluated. If available, a neonatologist should be present at any ED delivery.

Three classic signs indicate delivery of the placenta: sudden lengthening of the cord, a gush of blood, and a change in the shape of the uterine fundus. Once the fetus is clear, gentle traction on the cord should continue until these signs are seen. After the placenta is delivered, typically within 20 minutes, it is inspected for irregularities that may suggest retained tissue. Manual abdominal massage of the uterine fundus will often assist in uterine contraction. An infusion of oxytocin, typically 20 units in a 1000-mL bag of normal saline infused at about 200 mL/h, can be administered to hasten separation and assist in contraction of the uterus back into the pelvis.

FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION

After the placenta is delivered and the neonate is stabilized, the mother should be evaluated for bleeding—the causes and treatment of which are covered next. If hemodynamically stable after the first postpartum hour, the mother may be transferred to the postpartum floor.

POSTPARTUM HEMORRHAGE

EPIDEMIOLOGY

Hemorrhage is a significant cause of maternal morbidity and is the second most common cause of peripartum deaths (following amniotic fluid embolism). Hemorrhage was a direct cause of more than 18% of 3201 pregnancy-related maternal deaths in the United States from 1991 to 1997. worldwide, hemorrhage has been identified as the single most important cause of maternal death and is responsible for almost half of all postpartum deaths in developing countries. Postpartum hemorrhage is the term used to describe excessive blood loss after delivery. Classically, it is defined as more than 500 mL of blood loss in a vaginal delivery or more than 1000 mL of blood loss in a cesarean delivery; however, careful quantitative measures reveal that blood loss in the range of 500 to 1000 mL is actually average for both types of delivery. Of note, practitioners often underestimate blood loss by as much as 50%. For the ED physician, the most important causes of hemorrhage in the postpartum period are birth trauma, uterine atony, uterine rupture, and uterine inversion.

PATHOPHYSIOLOGY

Separation and delivery of the placenta constitute the third stage of labor. With separation of the placenta, there is also
bleeding that, although moderate in appearance, may escape blood have been lost. Second, many patients will have steady pressure are insensitive indicators until large amounts of hypotensive. However, three factors make this classic manifestation of postpartum hemorrhage should be recognized as a potential complication of a precipitous delivery. The classic clinical manifestation is a woman with sudden massive vaginal bleeding who is tachycardic, pale, and possibly diaphoretic or hypotensive. However, three factors make this classic manifestation flawed. First, an elevated pulse and decreased blood pressure are insensitive indicators until large amounts of blood have been lost. Second, many patients will have steady bleeding that, although moderate in appearance, may escape notice until serious hypovolemia develops. Third, intrauterine, intravaginal, intraperitoneal, and retroperitoneal accumulation of blood can be overlooked.

In a reported case series on uterine inversion, the most common signs were shock and hemorrhage. With a complete inversion, the prolapsed uterus may be visible as a large, dark red polypoid mass within the vagina or protruding through the introitus. If the fundus remains within the vagina, the diagnosis may be suspected because of dimpling, indentation, or absence of the uterine fundus on abdominal examination or because a mass is palpated in the cervix on bimanual examination. Establishing the diagnosis of incomplete inversion can be quite difficult; severe hypotension, postpartum hemorrhage, and subtle abnormalities on abdominal examination may be the only clues.

Uterine rupture is also a difficult clinical diagnosis and should be considered in any patient with unexplained peripartum hemorrhage or hypotension. The classic findings of uterine rupture are “ripping” or “tearing,” suprapubic pain and tenderness, absence of fetal heart sounds, recession of the presenting parts, and vaginal hemorrhage. Signs and symptoms of hypovolemic shock and hemoperitoneum may follow. This classic manifestation is actually rare; 87% of patients with uterine rupture have no pain and 89% have no vaginal bleeding. Pain is also an unreliable finding because of the altered response to noxious intraperitoneal stimuli by a stretched abdominal wall. Fetal distress is the most consistent finding (80% to 100%), with fetal bradycardia being the most common sign. Most reports of uterine rupture describe patients with normal blood pressure or even elevated blood pressure without tachycardia. Abnormal maternal vital signs are late indicators of severe hemorrhage. The most important risk factor for uterine rupture is a previous uterine scar; other factors are listed in Box 122.1.

**Presenting Signs and Symptoms**

Peripartum patients may lose a substantial amount of blood before becoming hypotensive or feeling symptomatic. Immediate postpartum hemorrhage should be recognized as a potential complication of a precipitous delivery. The classic clinical manifestation is a woman with sudden massive vaginal bleeding who is tachycardic, pale, and possibly diaphoretic or hypotensive. However, three factors make this classic manifestation flawed. First, an elevated pulse and decreased blood pressure are insensitive indicators until large amounts of blood have been lost. Second, many patients will have steady bleeding that, although moderate in appearance, may escape notice until serious hypovolemia develops. Third, intrauterine, intravaginal, intraperitoneal, and retroperitoneal accumulation of blood can be overlooked.

**Box 122.1 Risks for Uterine Rupture**

- **Surgery or Procedure**
  - Previous cesarean delivery (most common by far—1 in 125 subsequent pregnancies)
  - Previous uterine rupture
  - Previous myomectomy incision (1 in 40 subsequent pregnancies)
  - External or internal version
  - Breach extraction
  - Forceful uterine pressure during delivery

- **Trauma or Environmental**
  - Trauma
  - Cocaine use

- **Structural Anomaly**
  - Congenital fetal or uterine anomaly
  - Previous invasive molar pregnancy
  - Uteroplacental abnormalities: adenomyosis or placenta increta or percreta

- **Pregnancy Related**
  - Silent rupture in a previous pregnancy
  - Persistent, intense contractions (spontaneous or iatrogenic)
  - High parity (1 in 100 subsequent pregnancies); grand multiparity (>7) increases the risk for rupture 20-fold
  - In vitro fertilization
DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING

Postpartum hemorrhage is a sign, not a diagnosis; it is important to consider the cause of the postpartum hemorrhage because it will often direct the treatment. The key to identifying the cause of postpartum hemorrhage is the physical examination. Because uterine atony is the most common cause of postpartum hemorrhage, accurate assessment of uterine tone is essential. To assess uterine tone, a hand is placed on the anterior wall of the uterus (over the fundus) to palpate it. If a soft, boggy, or very large uterus is felt, the diagnosis of uterine atony is established. At this point, management of uterine atony should be a priority over inspection for secondary causes of bleeding. If a firm, contracted uterus is felt, a search for other causes should be initiated promptly.

Without palpation or visualization of a frankly prolapsed uterus, it may be difficult to differentiate uterine inversion from severe atony. Heavy bleeding may make visualization of the cervix impractical. In addition, accurate abdominal palpation for a uterine fundus may be impossible in an obese patient. Depending on factors such as patient stability, resources, and diagnostic uncertainty, ultrasonography or laparotomy may be necessary. In stable patients in whom the diagnosis is uncertain and resources are available, prompt ultrasound scanning may be helpful. Ultrasonography may be able to identify retained products or clot in the uterus, but manual exploration is still needed. Ultrasound can also help detect peritoneal free fluid suggestive of uterine rupture. In selected circumstances in stable patients, a computed tomography scan can be useful in making the diagnosis in those with postpartum hemorrhage (retroperitoneal hematoma). If the accompanying hemorrhage or shock is sufficiently alarming to require immediate exploration, the correct diagnosis may be established only at laparotomy.

Although congenital coagulation defects may be relatively rare, consumptive, dilutional, and disseminated intravascular coagulopathies are important considerations. Depletion of platelets and soluble clotting factors after blood loss and subsequent crystalloid and packed red blood cell replacement is difficult to distinguish clinically from disseminated intravascular coagulopathy. Placental abruption, amniotic fluid embolism, HELLP syndrome (hemolysis, elevated liver enzymes, and low platelet count), and intrauterine demise are pregnancy-related risk factors for disseminated intravascular coagulation. Initial laboratory studies include a complete blood count, coagulation studies, disseminated intravascular coagulation panel, liver function tests, and basic metabolic panel.

TREATMENT

The most important aspects of managing postpartum hemorrhage are obtaining hemostasis and treating shock, including supplemental oxygen, placement of two large-bore intravenous (IV) lines, hemodynamic monitoring, and volume replacement. In addition, blood should be typed and crossmatched and 4 to 6 units of packed red blood cells should be available. Consultation with the obstetrics service should be arranged. Along with the initial resuscitation, bimanual massage and IV oxytocin should be initiated (Fig. 122.1 and Table 122.1). A Foley catheter should be placed.

If the placenta has been delivered, manual uterine exploration may reveal uterine rupture or retained products or clots (which should be removed manually to improve uterine contraction). If the placenta is still in place and bleeding is ongoing, the placenta should be removed if a distinct cleavage plane is palpated on exploration. If an indistinct cleavage plane is revealed, the diagnosis of placenta accreta is likely. In this case the placenta should not be removed in the ED. Bimanual uterine compression should continue, with the goal being to stabilize patients until they can be taken to the operating room.

Trauma to the genital tract can be diagnosed by careful inspection of the labia, vagina, and cervix for laceration or hematoma. Noncomplex (first or second degree), easily accessible lacerations can be repaired with absorbable suture. Cervical lacerations and third- and fourth-degree lacerations should be repaired by an obstetrician. Temporary hemostasis may be achieved by direct pressure or, in the case of cervical lacerations, by gentle application of ring forceps to the bleeding point.

Retroperitoneal hematoma is a potentially life-threatening condition that may be manifested as hypotension, cardiovascular shock, or flank pain. Once a diagnosis is made, treatment should be supportive until the obstetrician, interventional radiology, or the operating room is available.

First-line interventions for atony are part of the initial management of postpartum hemorrhage—namely, initiation of bimanual uterine compression, IV oxytocin, and clearing of products of conception and clots from the uterus. If bleeding persists after the initial interventions, additional uterotonics should be given (see Table 122.1). The choice of agent may be influenced by the side effect profile, but the best drug is probably the agent that is most quickly available in the ED. Interventional radiology may be beneficial because embolization may control the bleeding. In any case, temporizing measures may be required until definitive intervention (Table 122.2).

Uterine tamponade with sterile gauze and balloon tamponade are commonly used temporizing measures. Uterine balloon tamponade has been described with large Foley catheters, Sengstaken-Blakemore tubes, condom catheters, sterile gloves, and Rusch urologic catheters, as well as with catheters specifically designed to be used for uterine tamponade in patients with postpartum hemorrhage (SOS Bakri tamponade balloon).

UTERINE INVERSION

Management of uterine inversion has two important components: treatment of hemorrhagic shock and immediate reposi-tioning of the uterus (Fig. 122.2). Resuscitation should be initiated immediately and continued while attempts are made to reposition the uterus manually. If oxytocin is being infused, it should be stopped once uterine inversion is suspected.

The success of nonsurgical replacement depends on completion before the myometrium regains its tone. The reported rate of successful immediate reduction is between 40% and 80%. If initial measures are delayed or fail to relieve the condition, the inversion may progress to the point at which operative treatment or even hysterectomy is necessary.

The most common nonsurgical replacement method is a variation of the Johnson maneuver. The prolapsed uterus is
Fig. 122.1 Algorithm for postpartum hemorrhage management strategies. ABCs, Airway, breathing, and circulation; AFE, amniotic fluid embolism; CT, computed tomography; CV, cardiovascular; DIC, disseminated intravascular coagulation; IR, interventional radiology; OB, obstetrics; OR, operating room; UI, uterine inversion; UR, uterine rupture.
If initial repositioning is unsuccessful, myometrial relaxation with pharmacologic agents should be attempted. Magnesium sulfate, terbutaline, and nitroglycerin (attractive because of its easy availability and short half-life) are the agents most commonly used (see Table 122.1). Attempts at manual repositioning of the uterus should continue. After successful reduction, the uterus should be supported for several minutes to allow the ligaments to return to their original state while uterotonics are administered. If magnesium sulfate was administered as a tocolytic, calcium gluconate can be given to reverse the tocolytic effect. Fluid and blood replacement and manual uterine massage should be maintained until the uterus is well contracted and the bleeding has stopped. Antibiotics should be started as soon as practical. Uterotonics are continued for at least 24 hours.

If all other efforts have failed to reposition the inverted uterus, operative intervention is required. If the uterus was repositioned with the placenta attached, manual removal can be attempted once the use of relaxants is stopped. Uterotonics should be initiated, and if the placenta cannot be removed easily, it should be left in place.

**UTERINE RUPTURE**

Initial management of uterine rupture differs and is based on the stability of the patient and fetus. Because the results of examination are normal in most patients with uterine rupture and because fetal distress is the most common finding, initial management will probably be the same as that for other causes of acute fetal distress—urgent delivery.

The physician should consult obstetrics on an emergency basis, ensure adequate IV access, notify the blood bank, and alert the neonatal team to be ready for intensive care newborn...
resuscitation. If these resources are not available in the hospital, arrangements should be made for immediate transfer. For unstable patients, prompt, aggressive resuscitation is an important temporizing measure until definitive surgical repair is performed. Fetal morbidity almost invariably occurs because of catastrophic hemorrhage, fetal anoxia, or both. In a study of 99 cases of uterine rupture, the best fetal outcomes were noted when surgical delivery was accomplished within 17 minutes from the onset of fetal distress.7

If the patient is stable, no signs of fetal distress are present, or the diagnosis is unclear, ultrasonography can be useful. Ultrason sound findings include lack of normal orientation, uncertain placental location, fetal demise, and absence of amniotic fluid.

**FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION**

Obstetric consultation should be obtained on an emergency basis to assist in the delivery and postpartum care of the mother, as well as pediatric or neonatal services for the newborn. All patients who deliver in the ED should be admitted to an obstetric floor after delivery or stabilization of the acute complication.

**PERIMORTEM CESAREAN DELIVERY**

**EPIDEMIOLOGY**

Maternal arrest is estimated to occur in 1 in 4000 to 6500 pregnancies in the United States.14-16 In any maternal arrest that occurs beyond 24 weeks’ gestation, perimortem cesarean delivery should be considered as a potentially lifesaving intervention for both the mother and the fetus.17

When comparing causes of death in the cohort of women undergoing perimortem cesarean delivery with all maternal deaths, trauma accounts for a larger proportion in the former group.18 Perimortem cesarean delivery is one of the oldest

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**Table 122.2 Temporizing Measures for Hemostasis of Postpartum Hemorrhage**

<table>
<thead>
<tr>
<th>METHOD</th>
<th>PROCEDURE</th>
<th>COMMENTS</th>
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<tbody>
<tr>
<td>Uterine packing</td>
<td>Layer sterile gauze within the uterus, with the distal end going out through the os</td>
<td>May adhere to the uterine wall and removal required; does not allow monitoring of ongoing bleeding; start prophylactic antibiotics</td>
</tr>
<tr>
<td>Balloon tamponade</td>
<td>If available and time allows, use bedside ultrasonography to confirm that the balloon is beyond the internal os before inflation to avoid damage to the cervical canal; give prophylactic antibiotics and continue oxytocin infusion</td>
<td></td>
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<tr>
<td>Foley catheter</td>
<td>Insert a large bulb catheter (24 French) into the uterus; Instill with 80-100 mL of saline; Pack the vagina to avoid expulsion of the catheter</td>
<td>Multiple catheters may be needed (in a sterile overbag), which makes the inner lumen difficult to monitor</td>
</tr>
<tr>
<td>SOS Bakri balloon</td>
<td>Insert into the uterus; Instill 300-500 mL of saline through the stopcock; Pack the vagina</td>
<td>Best option if available; allows direct measurement of ongoing bleeding via the open inner lumen; developed for postpartum hemorrhage; balloon conforms to the shape of the uterine cavity</td>
</tr>
<tr>
<td>Sengstaken-Blakemore tube</td>
<td>Cut off the distal (“stomach”) end of the tube; Insert inside the uterine cavity; Infuse 75-300 mL of saline; Pack the vagina to avoid expulsion of the tube</td>
<td>Does not conform to the shape of the uterine cavity; with the end cut off, proximal bleeding can be monitored through the lumen; may be available from the gastrointestinal department laboratory if not available in the emergency department</td>
</tr>
<tr>
<td>Rusch catheter</td>
<td>Using a 60-mL bladder syringe, inflate the balloon via the drainage port with 150-500 mL of saline; Pack the vagina to avoid expulsion of the tube</td>
<td>Urologic catheter used for bladder stretching; may be available in the urology department</td>
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<tr>
<td>Condom catheter</td>
<td>Slide the condom over the end of the Foley catheter and tie it off with string to close the end; Inflate with 250-500 mL of saline and clamp the end; Pack the vagina to avoid expulsion of the tube</td>
<td>A sterile rubber catheter is fitted with a condom</td>
</tr>
<tr>
<td>Vaginal packing</td>
<td>Pack the vagina with a blood pressure cuff placed inside a sterile glove; Increase pressure to 10 mm Hg above systolic blood pressure</td>
<td>Various techniques have been described; concern for bleeding proximal to the vaginal pack</td>
</tr>
<tr>
<td>Noninflatable antishock garment</td>
<td>Begin application at the ankles and progress sequentially up to the abdomen</td>
<td>Adjust the panels if any discomfort or dyspnea; contraindicated in women with heart failure or mitral stenosis</td>
</tr>
</tbody>
</table>
surgical procedures in history, with the first reference to a successful postmortem cesarean section recorded in 237 BCE. Under the emperors of Rome, the Caesars, a law decreeing that a child be excised from the womb of any woman who died late in pregnancy became known as the “lex caesare”—consequently the name cesarean operation. The first documented maternal survival after cesarean delivery was a Swiss woman sectioned by her husband in 1500.

**PATHOPHYSIOLOGY**

Even under ideal conditions, cardiac output from chest compressions in a gravid patient is about 10% of normal. Cardiac output can be improved by displacing the uterus or tilting the patient (left lateral decubitus position); however, a decrease in effective chest compressions occurs with an increase in the patient’s body tilt.

Fetal outcomes are most directly related to the time from maternal arrest to delivery. Other important variables are the maturity of the fetus, the performance and effectiveness of maternal cardiopulmonary resuscitation, the cause of the maternal arrest, and the availability of a neonatal intensive care unit (NICU).

**DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING**

Perimortem cesarean delivery is indicated for gravid patients more than 24 weeks pregnant (or the uterine fundus is four...
fingertip widths above the umbilicus if the gestational age is unknown) if arrest continues after 4 to 5 minutes of cardio-pulmonary resuscitation. In a study by Katz et al., among the cases with available data on maternal hemodynamics during resuscitation, more than half the women had a “sudden and often profound improvement, including return of pulse and blood pressure at the time the uterus was emptied.” The study concluded that perimortem delivery should be performed within 4 minutes of maternal arrest if resuscitation was ineffective. An update published in 2005 strongly supported this conclusion, and the 2010 American Heart Association guidelines for cardiac arrest associated with pregnancy agree with this window (even sooner if it is clear that the mother has a grave or nonsurvivable injury).}

**TREATMENT**

See Box 122.2, “Procedure for Perimortem Cesarean Delivery,” and Fig. 122.3.

**AMNIOTIC FLUID EMBOLISM**

**EPIDEMIOLOGY**

Amniotic fluid embolism and the resulting anaphylactoid syndrome of pregnancy occur in late pregnancy or immediately postpartum. Though rare (roughly 1 in 8000 to 80,000 pregnancies), it is responsible for about 10% of all maternal deaths in the United States and is the most common cause of peripartum death.

**PATHOPHYSIOLOGY**

Despite knowledge of this deadly syndrome for more than 80 years, its cause and pathophysiology are not fully understood. The criteria to make the diagnosis are still controversial, and no management interventions have been proved to improve outcomes or prevent the syndrome. The term anaphylactoid syndrome of pregnancy is considered more appropriate than the term amniotic fluid embolism because of lack of evidence supporting a causative embolic event.

Anaphylactoid syndrome of pregnancy, from a clinical, hemodynamic, and hematologic standpoint, is similar to anaphylaxis and septic shock and suggests the possibility of a shared pathophysiologic mechanism. The syndrome appears to be initiated after maternal intravascular exposure to fetal tissue. Fetal-maternal tissue transfer is common and probably normal. It is proposed that when fetal antigens breach a maternal immunologic barrier in some women, release of endogenous mediators is triggered, and an anaphylactoid syndrome can occur.

Neurologic damage is seen in as many as 85% of survivors of anaphylactoid syndrome. The mechanism of neurologic injury is thought to be severe hypoxia leading to encephalopathy and seizures. The increased metabolic demand concurrent with seizures (seen in 50%) may worsen the brain injury, especially in the setting of hypoxia. Disseminated intravascular coagulation developed within 4 hours of initial evaluation in more than 80% of patients. If diffuse bleeding occurs, hemorrhagic shock can contribute to the hypotension.

**PRESENTING SIGNS AND SYMPTOMS**

The classic manifestation of anaphylactoid syndrome of pregnancy is acute hypoxia or respiratory arrest with associated cardiovascular failure, altered mental status, seizures, and coagulopathy in the immediate peripartum period. It typically occurs abruptly and with catastrophic outcomes, but less severe forms of this syndrome have been described. In about 10% of patients the diagnosis is made postpartum, and it has been diagnosed as late as 48 hours postpartum.

**DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING**

The National Registry’s criteria for the diagnosis of amniotic fluid embolism are included in Box 122.3. The diagnosis of

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**BOX 122.2 Procedure for Perimortem Cesarean Delivery**

Using a No. 10 blade, make a midline vertical incision that goes through all abdominal layers to the peritoneal cavity, which extends from the umbilicus to the pubic symphysis.

Separate the rectus muscles in the midline and enter the peritoneum. If available, retractors can be used to expose the anterior surface of the uterus. If the bladder is full, it may be seen inferior to the uterus. A Foley catheter is optimal, but under pressing conditions the bladder can be drained with a small scalpel incision and applied pressure.

To enter the uterus, start with a vertical incision through the lower uterine segment until amniotic fluid is obtained or the uterine cavity is clearly entered. Next, lift the uterine wall away from the fetus with two fingers and use blunt scissors to extend the incision vertically to the fundus; allow generous exposure. The membranes should be ruptured and the baby delivered.

Suction the infant’s mouth and nose, and clamp and cut the cord. If the mother regains stable vital signs, remove the placenta and repair the uterus, abdomen, and bladder.

**Fig. 122.3 Perimortem cesarean delivery: fetal outcomes in relation to time interval from maternal arrest to delivery.**

% Infants 100

<table>
<thead>
<tr>
<th>Time interval (minutes)</th>
<th>% Survival</th>
<th>% Neuro intact</th>
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<tbody>
<tr>
<td>0-5</td>
<td>80</td>
<td>10</td>
</tr>
<tr>
<td>6-10</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>11-15</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>16-25</td>
<td>0</td>
<td>100</td>
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SECTION XII WOMEN’S HEALTH AND GYNECOLOGIC DISEASES

BOX 122.3 National Registry Criteria for the Diagnosis of Amniotic Fluid Embolism

- Acute hypotension or cardiac arrest
- Acute hypoxia (defined as dyspnea, cyanosis, or respiratory arrest)
- Coagulopathy (defined as laboratory evidence of intravascular consumption or fibrinolysis or severe clinical hemorrhage in the absence of other explanations)
- Onset during dilation and evacuation, labor, cesarean delivery, or within 30 minutes postpartum
- Absence of other significant, confounding conditions or explanation of the symptoms and signs listed here


BOX 122.4 Differential Diagnosis of Anaphylactoid Syndrome of Pregnancy (Amniotic Fluid Embolism)

**Cardiovascular Collapse, Hypotension**
- Acute coronary syndromes, myocardial infarction
- Cardiomyopathy
- Pulmonary embolism
- Anesthesia complications, transfusion reaction
- Sepsis, systemic inflammatory response syndrome

**Respiratory Arrest**
- Pulmonary embolism, air embolism
- Anesthesia complications, transfusion reaction
- Aspiration

**Altered Mental Status, Seizure**
- Eclampsia
- Cerebrovascular accident
- Hypoglycemia

**Coagulopathy**
- Disseminated intravascular coagulation
- Consumptive coagulopathy from hemorrhage

anaphylactoid syndrome of pregnancy is one of exclusion. Its dramatic and rapid onset should prompt immediate action; death has been reported in 30 minutes to 7 hours after onset, with most deaths occurring within the first 2 hours. The initial signs and symptoms can be difficult to differentiate from those seen with other serious causes, but management, with a focus on cardiopulmonary stabilization, is similar (Box 122.4).

**TREATMENT**

No studies have shown that targeted intervention improves maternal prognosis. Management includes early definitive airway control with endotracheal intubation, IV fluids, vasopressors, and inotropes as needed. The blood bank should be notified and packed red blood cells, platelets, fresh frozen plasma, cryoprecipitate, and factor replacement should all be used as needed to treat disseminated intravascular coagulation. If the fetus is still not delivered at the time of arrest, perimortem cesarean delivery should be initiated within 4 to 5 minutes of resuscitation.

**RED FLAGS**

Underestimating the degree of blood loss in patients with peripartum hemorrhage or not appreciating moderate-appearing bleeding

Delaying uterine inversion replacement, which increases mortality (increases the risk and degree of hemorrhage and shock) and decreases the likelihood of successful nonsurgical repositioning because of cervical constriction

Not performing emergency cesarean delivery in maternal (>24 weeks of gestation) cardiac arrest not immediately reversed by cardiopulmonary resuscitation

Overlooking intrauterine, intravaginal, intraperitoneal, or retroperitoneal accumulation of blood in a hemodynamically unstable peripartum patient

Presuming that patients with active bleeding are stable because they have normal vital signs

**FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION**

Patients who survive long enough to be transferred to the intensive care unit have a better prognosis, but the overall mortality is reported to be 60%. In one study, only 8% of patients who had cardiac arrest as part of the initial findings survived neurologically intact. The infant survival rate was reported to be 70%, but almost half of the survivors had neurologic damage. If arrest occurs, a short arrest-to-delivery interval is associated with improved neonatal outcomes.

**REFERENCES**

References can be found on Expert Consult @ www.expertconsult.com.
NONVERTEX PRESENTATION IN DELIVERY

EPIDEMIOLOGY

Excluding nuchal cord, breech presentation is the most common malpresentation of the fetus. It complicates 4% of all births with a bias toward premature, low-birth-weight infants. Frank breech is the most common, followed by footling and complete. Prolapsed umbilical cord is a dreaded complication of breech presentation and was demonstrated to be a negligible risk with frank breeches, occurred about 5% to 6% of the time with complete breeches, and had an alarming incidence of 15% to 20% with footling breeches.26

PATHOPHYSIOLOGY

Breech presentation is typically divided into complete (hips and knees flexed), frank (hips flexed, knees extended), and incomplete (one or both hips extended, termed footling). Prematurity and congenital defects are the primary risk factors associated with breech presentations. Because of the abnormal presenting body part, the cervical aperture may not be fully occluded, which can allow the cord to potentially prolapse and entangle with the fetus at any point after membrane rupture. Alternatively, a nuchal arm may occur in which the fetal arm is entrapped posterior to the neck. This complication may result in fracture of the clavicle or humerus, brachial plexus injury, or hypoxic insult from entrapment of the fetal head.

The other nonvertex presentations include face, brow, and transverse lie. In a face presentation the fetal head is in full extension. A brow presentation is midway between this and vertex. A transverse lie is an instance in which the fetal pole is transverse relative to the maternal pelvis, a situation likely to never be seen by an ED physician given the impossibility of delivering a fetus in this position.

DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING

The differential diagnosis for fetal malpresentation includes breech (as well as determination of the subtype of breech), other nonvertex presentations, prolapsed umbilical cord, and multigestation delivery. Shoulder dystocia, though certainly an abnormal presentation, is easily differentiated by its occurrence after the delivery of a vertex head. One must also be vigilant for the potential aforementioned complications associated with breech delivery—a nuchal arm (fetal arm entrapped posterior to the neck) and a prolapsed, entrapped cord.

When the sterile glove examination is performed, the physician may feel either the buttocks (including the sacral bone, ischial tuberosities, and anus—the latter two occurring in a horizontal line with respect to each other) or one of the extended fetal legs. Insertion of a finger into the fetal anus should reveal the reflexive sphincter tone. There may also be meconium on withdrawal of the finger. Still, most ED physicians lack practical experience in identifying fetal presentation.

Ultrasound is extremely helpful in confirming fetal lie if it is available on an emergency basis. To date, no studies have evaluated the diagnostic ability of bedside ultrasound performed by emergency medical physicians in the setting of emergency delivery. Although information obtained from this modality is helpful, it does not directly alter the basic management principles of emergency delivery of a breech fetus; instead, it clues the physician to a potentially difficult delivery and underscores the need for urgent obstetric assistance.

TREATMENT

After assessment of the ABCs (airway, breathing, and circulation) of the mother, evaluation of fetal heart tones (FHTs), and a brief focused history, the physician should arrange for immediate obstetric/gynecologic and NICU assistance. Even though many breech presentations will be delivered with minimal complications, a significant proportion will not. Therefore, if at all possible, transfer to a facility with in-house obstetrics is indicated. If delivery is unavoidable, adequate nursing assistance will be needed. Frequent serial FHT measurements can be used to document fetal health, but ED management in the absence of obstetric/gynecologic assistance will not change based on these heart rates.

Although a few ancillary maneuvers may be called for during a breech delivery, the most important one is patience. It is generally agreed that the physician need only provide support to the mother until the umbilicus is at the introitus for two reasons. First, the cervix needs to have sufficient time to dilate to prevent entrapment of the aftercoming head. Second, traction on the fetal body will cause it to descend in the pelvis and remove the potential stabilizing effect of the contracted uterus on the fetal head. Without this effect, the head is likely to move from normal, stable flexion to extension. Hyperextension of the neck during passage can cause catastrophic cervical spine injury.

Maternal expulsive efforts are the primary force required to deliver the fetus. If it becomes clinically necessary, an episiotomy may be performed to provide additional working room and easier passage of the fetus. In addition, throughout any of the following maneuvers, gentle downward traction should be applied. Once accessible, the bony pelvis should be the landmark used to successfully grip and manipulate the fetus. A warm, wet towel over the fetus can help prevent slippage associated with vernix.

Although they often pass spontaneously, the legs may need assistance to be freed in a frank breech presentation. Once the buttocks have passed through the introitus, the provider frees a given leg by placing two fingers on medial aspect of the thigh and pushes laterally while holding the fetal body stable. This external rotation brings the knee through the introitus and frees the leg. This maneuver is then repeated on the other leg (Fig. 122.4).

No more than gentle downward traction should be applied until the fetal scapulae are visible. At this point, rotation of the fetal torso 90 degrees in one direction should elicit delivery of a shoulder, followed by 180-degree rotation in the other direction for the remaining shoulder (clockwise for the left and counterclockwise for the right) (Fig. 122.5). The goal is
to turn the fetus “into” the shoulder that is attempting to be freed. If this maneuver does not free the shoulder, a nuchal arm should be suspected. The physician should attempt to manually splint and sweep the flexed arm over the thorax (in a manner similar to posterior shoulder delivery for shoulder dystocia) to enable its passage. Upper extremity and clavicle fractures are a common complication.

The Mauriceau maneuver (Fig. 122.6) is used if the fetal head fails to pass easily. The physician slips the index and middle fingers under the anterior surface of the fetus and places them against the fetal maxilla. The fetal torso therefore rests on the physician’s forearm with the legs straddling down. The other hand is then inserted over the fetal back to grasp the shoulders and provide downward traction in concert with traction on the maxilla, not the mandible, to keep the fetal head in flexion during its removal. The physician should kneel on one knee while performing this maneuver to be at the level of the maternal pelvis and prevent the tendency to lift the fetus (and extend the neck) while extracting. Ancillary staff may provide suprapubic pressure to assist in this maneuver, which should be performed in tandem with maternal expulsive efforts.

Once delivered, the neonate should be assessed and resuscitated in the usual fashion. Treatment of the mother should continue as usual until passage of the placenta and assessment for hemorrhage or other postpartum complications.

If at any point an entangled umbilical cord should become apparent, manual decompression should be performed. If it cannot be manually reduced immediately, all maternal efforts to push should be stopped, and emergency cesarean section is required. Other temporizing measures include placing the mother in the knee-chest position, filling the bladder with saline, or tocolysis—ideally these measures should be decided with obstetric consultation.

Face, brow, and transverse presentations are simple to manage from an emergency medicine perspective. Face and brow presentations may spontaneously evolve to a favorable situation, thereby giving rise to the obstetric adage “if a face is progressing, leave it alone.” Any facial or brow presentation that does not progress and every transverse lie require surgical intervention. There are no additional ED maneuvers for these presentations, only for their potential complications such as prolapsed cord or hemorrhage.

**FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION**

Obstetric consultation should be obtained on an emergency basis to assist in the delivery and postpartum care of the mother, as well as pediatric or neonatal services for the newborn. All patients who deliver in the ED should be admitted to an obstetric floor after delivery or stabilization of the acute complication.

**CORD-RELATED COMPLICATIONS**

**EPIDEMIOLOGY**

Higher rates of prolapse and entanglement are associated with abnormalities in fetal presentation, such as abnormal lie, breech orientation, and compound presentation, with prematurity, and with multiple gestations. A nuchal cord is extremely common, with at least one loop appearing in upward of 30% of pregnancies. This finding alone rarely results in fetal morbidity and should perhaps be considered a normal variant.

**PATHOPHYSIOLOGY**

Umbilical cord complications can occur in any delivery. Because of the compact environment, the fetal limbs are closely approximated to the body and are rarely the site of entanglement. Instead, loops of cord are more commonly found around the neck or fetal torso. Compression most often
CHAPTER 122  EMERGENCY DELIVERY AND PERIPARTUM EMERGENCIES

Fig. 122.6 Cephalic flexion is maintained by pressure (heavy arrow) on the fetal maxilla (not the mandible). Frequently, delivery of the head is easily accomplished with continued expulsive force from above and gentle downward traction. (From Gabbe SG, Niebyl JR, Simpson JL, et al. Obstetrics—normal and problem pregnancies. 5th ed. Philadelphia: Churchill Livingstone; 2007.)

Fig. 122.5 When the scapulae appear under the symphysis, the operator reaches over the left shoulder, sweeps the arm across the chest (A), and delivers the arm (B). Gentle rotation of the shoulder girdle facilitates delivery of the right arm (C). (From Gabbe SG, Niebyl JR, Simpson JL, et al. Obstetrics—normal and problem pregnancies. 5th ed. Philadelphia: Churchill Livingstone; 2007.)

occurs as the cord passes through the cervix or, rarely, from tension applied around an entangled fetal part. The most important factor in these situations is patency of the umbilical vessels with sufficient blood flow. If a cord is tightly entrapped or impacted on a structure, blood flow will be inadequate and fetal hypoxia will result. Functionally, the only way to prevent fetal hypoxia in this situation is to restore umbilical blood flow either by manually decompressing the cord or by completing delivery so that the fetus is capable of oxygenating independently.

DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING

Umbilical cord prolapse is a fairly straightforward diagnosis that is made by identifying the cord on passage through the introitus or by palpation during vaginal examination. Given the unreliable presence of continuous tococardiographic monitoring in the ED, monitoring of the fetal heart rate cannot be the main modality used to help diagnose occult cord compression. Nuchal or torso loops are common, and several loops may be identified. Rarely, knots, kinks, or torsion of the cord
TREATMENT

As with any patient in labor, the ABCs, FHTs, and a brief focused history are the first priority. Early obstetric and neonatal help should be called once either emergency delivery or a cord-related complication is recognized. Sufficient ancillary staff to resuscitate two patients should be available, and a type and crossmatch should be ordered for both potential hemorrhage and Rh antigen determination.

As soon as cord prolapse is recognized, the treatment of choice is emergency cesarean section. Manual decompression of the umbilical cord from the fetal presenting part must be maintained until cesarean section is performed. If accomplished in less than 10 minutes, infant mortality from prolapse drops significantly. Compression usually occurs at the level of the cervix because this is the point of smallest diameter in the birth canal (especially when the presentation is nonvertex). When prolapse is recognized, all maternal pushing should cease. The clinician must provide continuous manual separation of the presenting part from the cord to maintain patent flow until an emergency cesarean section is performed. Other techniques to assist in removing some pressure from the cord are to place the mother in either the Trendelenburg or knee-chest position while continuing to hold manual decompression.

In the rare instance in which obstetric surgical assistance is not going to be available on a timely basis, the provider may need to manually reduce the cord into the uterus and rapidly deliver the fetus vaginally. Reduction of the cord into the uterus, called funic reduction, should be done only when consultation with an obstetrician reveals that no other viable option is available to quickly treat the prolapse.

In the case of nuchal or body loops, it should be remembered that a loose loop of cord will probably still have good perfusion. It has been repeatedly demonstrated that a nuchal cord alone does not have a significant impact on fetal outcomes. Therefore, in the absence of arrest of labor or identifiable cord entrapment, the cord should simply be reduced from the fetal neck and labor allowed to proceed as usual. However, excessive manipulation of the cord should be avoided to prevent vasospasm. Once the fetal mouth and nares are suctioned and spontaneous respirations are initiated, the cord may be clamped and separated from the neonate in the usual fashion.

FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION

Obstetric consultation should be obtained on an emergency basis to assist in the delivery and postpartum care of the mother, as well as pediatric or neonatal services for the newborn. All patients who deliver in the ED should be admitted to an obstetric floor after delivery or stabilization of the acute complication. Actively prolapsed cords need to be manually decompressed and the mother taken to the operating room for delivery by cesarean section on an emergency basis.

SHOULDER DYSTOCIA

EPIDEMIOLOGY

Shoulder dystocia is recorded to occur in anywhere from 0.2% to 3% of all births—the variance being caused by discordant definitions of this condition. Spong et al. proposed criteria that include greater than a 60-second delay between delivery of the fetal head and delivery of the body or the use of ancillary delivery maneuvers, but this was found to prospectively identify only 72% of cases of shoulder dystocia.

Many risks for shoulder dystocia have been proposed, including (but not limited to) fetal macrosomia, maternal diabetes, maternal obesity, and previous history of dystocia. However, most studies that have posited these risk factors for dystocia are retrospective and are not borne out prospectively. The most consistent risk factor is fetal macrosomia—based on actual, not estimated weight. Still, even for neonates weighing more than 4000 g at delivery, shoulder dystocia will complicate only 3.3% of deliveries.

Although its occurrence can be terrifying, death from dystocia is relatively rare. One study showed the approximate incidence of fatal shoulder dystocia to be 0.025 per 1000 deliveries. The most common injury associated with shoulder dystocia is brachial plexus palsy, which has been reported in up to 20% of deliveries involving shoulder dystocia. Thankfully, the large majority of these palsies are transient.

PATHOPHYSIOLOGY

In shoulder dystocia, the fetal shoulders fail to clear the pelvis properly. The fetus assumes a position that places the shoulders in an anteroposterior plane between the pubis and sacrum, whereas in a normal delivery they are slightly oblique from this orientation (Fig. 122.7). This abnormal position forces the fetus to pass through a narrower pelvic diameter, which results...
in shoulder impaction. Most of the time the impaction occurs when the anterior shoulder fails to clear the pubis. Maneuvers that augment these impactions are the basis of treatment.

**DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING**

Shoulder dystocia is caused by arrest of labor after passage of the fetal head. It classically results in the “turtle sign,” in which the fetal head retracts against the perineum after it is delivered because of shoulder impaction on the pelvis. Because most causes of arrest of labor occur before passage of the head, the only other significant clinical entity to consider is uterine rupture. In this instance, failure of uterine integrity leads to compromised fetal expulsive force and similar retraction of the fetal head. This complication is discussed in the earlier section of this chapter on causes of postpartum hemorrhage.

The diagnosis of dystocia is typically confirmed when application of gentle downward traction does not lead to progression of labor. The head is typically facing 3 or 9 o’clock with respect to the mother. The majority of cases of dystocia are described as being related to anterior shoulder impaction. Posterior or bilateral shoulder dystocia can also occur and should be suspected if the initial maneuvers aimed at clearing the anterior shoulder fail to produce fetal passage. This degree of impaction is quite complicated and will probably require obstetric expertise to alleviate.

Shoulder dystocia is a purely clinical diagnosis. No laboratory or radiologic testing is needed or helpful in its diagnosis.

**TREATMENT**

The most important issue in treating shoulder dystocia is to be prepared; providers must quickly recognize its clinical features and be knowledgeable about treatment techniques. Panicked forceful traction on the fetal head and neck will not disimpact a dystocia and may lead to fetal injury, which may include fetal clavicular or humeral fracture, brachial plexus injury, or worst of all, fetal hypoxia with brain damage or death.

Shoulder dystocia must be suspected if passage of the fetal body is delayed after delivery of the head. If it has not already been done, an obstetrician and NICU or pediatrician staff member should be called for assistance immediately. The mother should be monitored appropriately, and if available, a FHT monitor should be applied. If the latter is not possible, tococardiographic measurements should be obtained and trended.

If the anterior shoulder does not deliver spontaneously, the provider may grasp both fetal parietal eminences and provide downward shifting motion traction to “slip” the shoulder under the pubis. A rotary, fulcrum, or bending motion that brings one fetal ear closer to the ipsilateral shoulder should be avoided to prevent brachial plexus injury (Fig. 122.8).

The delivering physician should exert mild downward traction on the fetal head while keeping the cervical spine in line. This maneuver prevents use of the head as a fulcrum to “pry” the shoulder free, which could lead to stretching of the fetal neck and brachial plexus. If this does not result in fetal progression, the McRoberts maneuver should be performed next. Ancillary staff should provide suprapubic pressure concurrently. The McRoberts maneuver (Fig. 122.9) is performed by tightly flexing the maternal hips or knees to “pull” the pubis back over the anterior fetal shoulder, ideally inducing its passage. This maneuver is favored first by most clinicians because of its simplicity and effectiveness—retrospective studies, however, indicate it works approximately 40% of the time. These studies have shown that if this maneuver is combined with suprapubic pressure, the success rate climbs to between 54% and 59%. Suprapubic pressure (Fig. 122.10) is intended to aim a force directly over the site of the impacted anterior shoulder and assist it in sliding beneath the pubis. Fundal pressure has not been shown to be effective in disimpacting a shoulder and should not be used. If the mother is clinically stable and there is a stable surface on which to perform it, the “all-fours” or “Gaskin” position may be attempted. The reversal of gravitational force combined with altered pelvic dimensions may result in disimpaction—50% of cases in one series were managed by this technique alone. The aforementioned maneuvers may be repeated in this position.

If these techniques are not successful, the physician should attempt a Woods screw or Rubin maneuver. In the Woods screw maneuver the physician palpates the posterior shoulder and exerts a force on its anterior side to effect a rotation. This brings the posterior shoulder around to the anterior side, which both frees the anterior shoulder and aligns both shoulders in the ideal oblique pelvic plane. The Rubin maneuver (Fig. 122.11) is another rotational technique that is the reverse of the Woods screw maneuver: pressure is applied from the posterior side of whichever shoulder is reachable until fetal axial rotation occurs. Some inward pressure on the fetal head (into the vagina) may be required to disimpact a wedged shoulder before these techniques are used. The decision to perform either maneuver should be based on accessibility of the fetus and clinical response to their implementation.
The least invasive maneuver to disimpact the shoulders is the McRoberts maneuver. Sharp ventral flexion of the maternal hips results in ventral rotation of the maternal pelvis and an increase in the useful size of the outlet. (From Gabbe SG, Niebyl JR, Simpson JL, et al. Obstetrics—normal and problem pregnancies. 5th ed. Philadelphia: Churchill Livingstone; 2007.)


If these maneuvers fail, delivery of the posterior arm should be attempted. This should be the last intrapelvic maneuver attempted given its high association with fetal injury. Delivery of the posterior shoulder aims to reduce the bisacromial diameter (shoulder width) of the fetus, thereby returning the fetus to a dimension that can pass through the pelvis. This maneuver is technically difficult, and clavicular and humeral fractures with associated nerve damage may occur. The physician locates the posterior arm and first flexes the forearm with pressure applied into the acromioclavicular fossa. The flexed arm is then adducted over the chest of the fetus and out of the maternal pelvis (Fig. 122.12). If labor does not proceed with this maneuver alone, it may be combined with one of the aforementioned rotary techniques.

If access to the intrapelvic fetal body is suboptimal, an episiotomy is indicated. However, it is important to note that episiotomy is no longer routinely recommended during delivery. Management by episiotomy or proctoepisiotomy has been associated with a nearly sevenfold increase in the rate of severe perineal trauma without the benefit of reducing the occurrence of neonatal depression or brachial plexus palsy. Because of these findings, episiotomy is now recommended only on a clinical as-needed basis to perform maneuvers required to disimpact the fetal shoulders. Episiotomy alone will not alleviate the dystocia because it does nothing to correct the underlying impaction of the shoulder on the pelvis—it merely provides improved access to the fetal body to perform manipulations required to complete delivery. To perform an episiotomy, the vaginal fourchette and perineum are first anesthetized with 1% to 2% lidocaine. The physician’s fingers are used to both expose the area to be incised and provide a physical block between the scissors and the
Fig. 122.12  The operator inserts a hand and sweeps the posterior arm across the chest and over the perineum. Care should be taken to distribute the pressure evenly across the humerus to avoid unnecessary fracture. (From Gabbe SG, Niebyl JR, Simpson JL, et al. Obstetrics—normal and problem pregnancies. 5th ed. Philadelphia: Churchill Livingstone; 2007.)

delivering fetus. The scissors are then used to incise through about one half of the perineum. Care must be taken to try to avoid extending into the anal sphincter or, worse yet, into the anal mucosa and cause third- or fourth-degree lacerations, respectively.

Fig. 122.11  Rubin or reverse Wood screw maneuver for shoulder dystocia. A, Rotate the posterior shoulder. B, Deliver the rotated shoulder. (From Roberts JR, Hedges JR. Clinical procedures in emergency medicine. 5th ed. Philadelphia: Saunders; 2009.)

PREMATURE RUPTURE OF MEMBRANES AND PRETERM PREMATURE RUPTURE OF MEMBRANES

EPIDEMIOLOGY

Rupture of fetal membranes occurring without evidence of labor is called PROM. It occurs infrequently—less than 5% of pregnancies are affected. If this event takes place before 37 weeks' gestation, it is called PPROM. Factors that have been associated with PROM include infections, maternal smoking, placentation abnormalities such as abruption or previa, malnutrition, and connective tissue disorders.

PATHOPHYSIOLOGY

The chorion and amnion make up the commonly labeled "membranes" that surround the growing fetus, with the tougher and thicker chorion surrounding the thinner and more elastic amnion. As pregnancy progresses, the structural integrity of these membranes degrades. This breakdown, combined with a dilating cervix to act as a focal stress point, is thought to allow timely, spontaneous rupture in a normal delivery.

Amniotic fluid contents have certain biochemical differences from vaginal fluid, and these differences are the basis of some common tests that allow accurate diagnosis of PROM: a higher pH (higher in amniotic than in vaginal fluid) and the tendency of amniotic fluid to microscopically crystallize or "fern" when allowed to air-dry on a glass slide.

FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION

Obstetric consultation should be obtained on an emergency basis to assist in the delivery and postpartum care of the mother, as well as pediatric or neonatal services for the newborn. If evidence of fetal distress develops or if routine maneuvers fail to lead to progression of labor, emergency delivery by cesarean section may be necessary.
DIFFERENTIAL DIAGNOSIS AND MEDICAL DECISION MAKING

The differential diagnosis for fluid leakage includes bleeding, infection, and urinary incontinence. A good history, combined with sterile speculum examination possibly supplemented by Nitrazine pH testing, will often differentiate these causes.

The most common complaint in patients with PROM and PPROM is passage of fluid from the vagina. It may be very small in quantity or comparable with the volume noted at the onset of normal labor. There is often continuous seeping of fluid with visible pooling in the posterior vaginal vault, and the physician may notice leakage of clear fluid from the still-closed cervix. This leakage may be exacerbated by fundal pressure or coughing.

The history will often reveal a lack of associated contractions, although the presence of Braxton-Hicks contractions may complicate the diagnosis; differentiation is best left to the obstetrician with access to full maternal-fetal monitoring. However, sterile speculum examination in the ED should allow adequate visualization of the cervix to determine whether it is dilated.

The most significant variant is premature rupture with chorioamnionitis. Symptoms that suggest this infection are fever, uterine tenderness, maternal or fetal tachycardia, malodorous vaginal discharge, or elevated maternal white blood cell count. However, none are sufficiently sensitive or specific alone.

MANAGEMENT AND DISPOSITION

As with every third trimester patient encounter, assessment and stabilization of maternal ABCs and fetal FHTs are the initial priorities. If the patient complains of passage of fluid, sterile speculum examination is performed to determine whether any cervical dilation has occurred. If active crowning is observed, ED delivery should be anticipated. If signs of active labor are present but no presenting part is visible, digital examination is indicated to further assess dilation, station, and effacement. If fluid is noted on examination without associated signs of labor, digital examination is contraindicated and a work-up for PROM or PPROM can begin.

Beyond recognition of PROM and PPROM, the most important intervention is to abstain from a digital vaginal examination. The risk for chorioamnionitis after premature membrane rupture appears to be directly related to the number of examinations performed. Recent data suggest that there is no increase in infectious complications if the number of examinations is less than two. Nevertheless, only a sterile speculum examination should be performed in the ED.

Nitrazine testing of vaginal fluid may be performed because of its speed and simplicity. This information may be helpful for the consulting obstetrician but will probably not change management in the ED. Most EDs are equipped with Nitrazine, typically for ophthalmologic evaluation, and performance and interpretation of this test can take place at the point of care. The vagina is typically an acidic environment, so a pH higher than 6.5 is consistent with ruptured membranes. Published sensitivities for this test range from 77% to 92%, with false results most commonly being caused by inadequate samples or the presence of blood or bacterial infection of the vagina. Many EDs do not have a microscope easily available, and thus testing for ferning of the suspect fluid may be impractical.

Particular attention should be focused on evaluating for chorioamnionitis. If maternal fever or unexplained tachycardia is present, the clinical examination should focus on other signs or symptoms of chorioamnionitis. For fetuses younger than 34 weeks and potentially as late as 37 weeks, prophylactic antibiotic administration for PPROM has significantly improved outcomes. For patients after 37 weeks, who by definition have PROM, the question of antibiotics is less clear. Unless clear evidence of infection or sepsis is present, consultation with the obstetrician before administering antibiotics is prudent.

Tocolytics are often used to prevent progression of labor along with coincident steroid administration to hasten fetal lung maturity in premature infants. However, unless the time to transfer of care is anticipated to be long, these agents should probably not be administered in the ED—and certainly not without obstetric consultation.

FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION

Obstetric consultation should be obtained on an emergency basis to assist in the care of a patient with suspected rupture of membranes, and in general, all these patients should be admitted or transferred to obstetric care for further management.

MULTIPLE GESTATIONS

EPIDEMIOLOGY

Since the advent of and mainstream access to in vitro fertilization treatments, the incidence of multiple-gestation pregnancies has risen greatly. However, these same patients are less likely to be in the pool of patients seen in labor in the ED because of the intensive prenatal care associated with fertility treatments. Patients who have twin or greater gestation by spontaneous means are also very likely to know of their status and thus testing for ferning of the suspect fluid may be impractical.

In dizygotic twins (DZ), two separate ova, introduced by either multiple ovulation or in vitro fertilization, are subsequently fertilized by two separate sperm. This results in twins that are as genetically different as siblings born at separate

PATHOPHYSIOLOGY

During gestation the fetus is surrounded by two separate membranes—the outer chorion and the inner amnion. This anatomic arrangement can be altered in the case of multiple gestations (twins, the most common multiple gestation, will serve as the reference point here) (Fig. 122.13).
EMERGENCY DELIVERY AND PERIPARTUM EMERGENCIES

CHAPTER 122

Differential Diagnosis and Medical Decision Making

The vast majority of twin pregnancies are discovered during prenatal ultrasound. Higher suspicion for a multigestation pregnancy in the ED should occur with patients who have not had prenatal care, if a uterus feels larger than anticipated for dates, or if contractions seem to continue after delivery of the first fetus. The most clinically useful tool is bedside ultrasound, which should easily distinguish a multigestational pregnancy.

Twin A will be in a vertex position about 80% of the time, with twin B being in vertex only half as often. Therefore, one must not only anticipate the high likelihood of prematurity associated with multiple gestations but must also be prepared for the potential for a nonvertex delivery for twin B.

TREATMENT

As with every gravid patient, evaluation of the ABCs and FHTs and a brief focused history are the first priorities. Obstetric and NICU assistance should be requested immediately, particularly given the universally increased morbidity and mortality associated with multiple gestations.

In the absence of complications, the delivery itself is handled the same as a singleton delivery—just repeated per each fetus. If a multigestation pregnancy is identified, arrangements for enough resources to handle the mother and each of the new patients need to be made early. After delivery of the first child, there is a variable period before active labor of the subsequent child. Maternal monitoring and frequent FHT evaluation should be performed during this time.

If twin A is nonvertex, every effort should be made to delay labor until a cesarean section can be performed. If twin A is vertex and B is not, attempted vaginal delivery is recommended if the estimated fetal birth weight (EFW) is greater than 2000 g. However, EFW measurements are not routinely performed in the ED, nor are continuous monitoring modalities or providers experienced in twin deliveries available. Therefore, the clinical status of the second twin and the availability of obstetric assistance should be used to decide the best course of action for twin B. The delay between delivery of twin A and twin B may be fortuitous and provide the needed time for obstetric assistance to arrive and assume care. If no help is available and crowning is occurring, the nonvertex twin B should be handled as any other nonvertex delivery.

FOLLOW-UP, NEXT STEPS IN CARE, AND PATIENT EDUCATION

Obstetric consultation should be obtained on an emergency basis to assist in the delivery and postpartum care of the mother, as well as pediatric or neonatal services for the newborn or newborns. All patients who deliver in the ED should be admitted to an obstetric floor after delivery or stabilization of the acute complication. If twins are known and twin A is nonvertex, delivery by cesarean section is indicated.
REFERENCES