Management of normal labor and delivery

Authors: Edmund F Funai, MD, Errol R Norwitz, MD, PhD, MBA
Section Editor: Charles J Lockwood, MD, MHCM
Deputy Editor: Vanessa A Barss, MD, FACOG

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INTRODUCTION — The World Health Organization (WHO) defines normal birth as "spontaneous in onset, low-risk at the start of labor and remaining so throughout labor and delivery. The infant is born spontaneously in the vertex position between 37 and 42 completed weeks of pregnancy. After birth, mother and infant are in good condition" [1].

This topic will present a paradigm for intrapartum management of women who are expected to have a normal birth. Many of the options for managing these women have not been studied in clinical trials or the data from clinical trials are insufficient for making strong recommendations for a specific approach [2]. Therefore, much of our approach is based upon our clinical experience, data from observational studies, and expert opinion.

Management of women with complicated labor and delivery is discussed in separate topic reviews (eg, malpresentation, protraction and arrest disorders, preterm labor, operative vaginal delivery, maternal medical/obstetrical disorders, hemorrhage) (refer to individual topic reviews on each subject).

PREPARATION — Four factors important in determining a woman's satisfaction with her childbirth experience are personal expectations, the amount of support she receives, the quality of the caregiver-patient relationship, and her involvement in decision-making. Childbirth education classes inform women and their partners about what to expect during labor and birth and provide a foundation for developing personal plans for the birth experience. (See "Preparation for labor and childbirth".)

One-on-one support by a doula during the birthing process may lower intrapartum analgesia requirements, decrease the rate of operative delivery, and increase satisfaction with the birth experience. (See "Continuous labor support by a doula".)

WHEN SHOULD LABORING WOMEN BE ADMITTED TO THE HOSPITAL — The appropriate time for hospital admission for women in labor with uncomplicated pregnancies is unclear. There is consensus that women in active labor should be admitted; cervical dilation ≥4 cm is one common threshold in research studies since most women enter the active phase of labor at 4 to 6 cm. Given that women cannot check their cervical dilation, many women will present for a labor check before cervical dilation reaches 4 cm. If mother and fetus are well and transport to the hospital is not a concern, should these patients be admitted to the Labor and Delivery Unit or sent home? Both approaches are probably reasonable. Although women admitted before 4 cm cervical dilation

are at higher risk for iatrogenic intervention, the maternal and perinatal consequences of sending these patients home have not been studied adequately.

In Washington State, the Bree Collaborative Obstetrics Care Report attempted to influence clinical practice by recommending admission for spontaneously laboring women at term with uncomplicated pregnancies only when cervical dilation was ≥4 cm [3]. The clinician determined whether the pregnancy was low-risk, as well as appropriate counseling and reassessment of women not admitted. Adherence to the recommendation was not mandatory. A retrospective cohort study of over 11,000 singleton, term deliveries in Washington State after this report observed a 10 to 15 percent increase in hospital admission at cervical dilation ≥4 cm [4]. Women admitted with cervical dilation <4 cm were more likely to have epidural anesthesia, oxytocin augmentation, and a cesarean delivery than women admitted with cervical dilation ≥4 cm. The authors were unable to identify women evaluated for labor, sent home because of cervical dilation <4 cm, and subsequently admitted, thus the safety and efficacy of this approach could not be evaluated.

MANAGEMENT OF THE FIRST STAGE OF LABOR

Initial examination — The goals of the initial examination of the parturient are to review her prenatal record for medical or obstetrical conditions that need to be addressed intrapartum, check for development of new disorders since the last prenatal visit, establish baseline cervical status so that subsequent progress can be determined, and evaluate fetal status.

On admission to the labor unit, vital signs include the woman's blood pressure; heart and respiratory rates; temperature; weight; frequency, quality, and duration of uterine contractions; and fetal heart rate (FHR).

Determining whether a woman is in labor is sometimes difficult as painful uterine contractions alone are not sufficient to establish a diagnosis of labor. Typically, the diagnosis is reserved for uterine contractions that result in cervical dilation and effacement over time. A recent history of membrane rupture or bloody show (vaginal discharge of a small amount of blood and mucus [ie, mucus plug]) supports the diagnosis.

Physical examination is performed with particular emphasis on the cervical examination. Digital examination is performed after placenta previa and preterm premature rupture of membranes (PPROM) have been excluded (by history and physical, laboratory, and ultrasound examinations, as appropriate).

The purpose of the initial examination is to determine:

- **Whether fetal membranes are intact or ruptured** – (See "Management of premature rupture of the fetal membranes at term".)

  If the membranes have ruptured, the presence of meconium is noted because of the possibility of meconium aspiration. (See "Clinical features and diagnosis of meconium aspiration syndrome".)

- **Whether uterine bleeding is present and excessive** – Placenta previa, vasa previa, and abruptio placenta can cause bleeding, and these disorders are potentially life-threatening to the mother and/or fetus. (See "Clinical features, diagnosis, and course of placenta previa" and "Velamentous umbilical cord insertion and vasa previa" and "Placental abruption: Clinical features and diagnosis".)

- **Cervical dilation and effacement** – In women with contractions, progressive cervical dilation and effacement on serial examinations or advanced cervical dilation and effacement on an initial examination is evidence of labor. Cervical dilation is faster after the cervix is completely effaced. [5]

- **Fetal station** – Fetal station is expressed as the number of centimeters of the leading bony edge of the presenting part above or below the level of the ischial spines (figure 1); the maximum denominator is 5 (eg, 1 cm beyond the ischial spines corresponds to +1/5 cm). Effacement and station are shown in the figures (figure 2A-B). An older system described fetal descent by dividing the distance from the ischial spines to pelvic outlet into thirds. Using this system, station +1/3 corresponds to +2/5 cm in the centimeter system. This assessment has largely been abandoned because it is even more subjective than the centimeter system and makes it difficult to document small, but clinically significant, degrees of descent.

  If a cervical examination is not performed because of ruptured membranes or vaginal bleeding, fetal descent can also be described in terms of fifths of the fetal head palpable above the symphysis pubis [6]. This method is also useful if there is significant molding (change in shape of the fetal skull) or caput (edema of the portion of the fetal scalp overlying the cervical opening) raising concerns about cephalopelvic disproportion.

- **Fetal lie, presentation, and position** – Document fetal lie, presentation, and position. Lie refers to the long axis of the fetus relative to the longitudinal axis of the uterus; it can be longitudinal, transverse, or oblique.

  Presentation refers to the fetal part that directly overlies the pelvic inlet; it is usually vertex (head) or breech (butt), but can be a shoulder, compound (eg, vertex and hand), or funic (umbilical cord).

  Fetal position is the relationship of a nominated site of the presenting part to a denominating location on the maternal pelvis, eg, right occiput anterior. The fontanelles and suture lines of the fetal skull and their orientation according to fetal position are illustrated in the figures (figure 3 and figure 4A-C and figure 5 and figure 6). Ultrasound examination can be useful if digital assessment is unclear, particularly for occiput posterior [7-9]. (See "Occiput posterior position", section on 'Diagnosis'.)

  Asynclitism refers to an oblique position of the fetal head where the head is tilted toward the shoulder and the parietal bone is the point of presentation.

- **Fetal size and pelvic capacity** – The clinician should make an attempt to determine whether the fetus is macrosomic, the pelvic type (figure 1), and whether the pelvis is contracted; however, these assessments are poorly predictive of the course of labor. (See "Shoulder dystocia: Risk factors and planning delivery of at risk pregnancies".)

  Pelvimetry (ie, quantitative measurement of pelvic capacity) can be performed clinically or via imaging studies (radiography, computed tomography, magnetic resonance imaging (figure 7A-B) [10-12]). Average and critical limit values for the various parameters of the bony pelvis have been established but do not accurately predict women at risk for cephalopelvic disproportion [13]. Pelvimetry has been replaced, in large part, by clinical trial of the pelvis ("trial of labor").

- **Fetal and maternal well-being** – Fetal status is assessed by the FHR pattern (see "Intrapartum fetal heart rate assessment"). Maternal assessment is primarily directed toward identifying development of new pregnancy complications, such as preeclampsia or infection.

Laboratory tests — Results from the following laboratory tests should be available at delivery, but intrapartum assessment is not always necessary.

- **Hemoglobin/hematocrit** – Although laboratory assessment of hemoglobin/hematocrit is commonly performed upon admission, there is no evidence that this practice is necessary in uncomplicated pregnancies. Relying on a normal hemoglobin result obtained at 26 to 28 weeks (ie, at the time of screening for gestational diabetes) appears to be a safe and acceptable approach [14,15].

- **Blood type and screen** – Rhesus (Rh) typing with a negative antibody screen at the first prenatal visit is probably adequate for women at low risk of postpartum hemorrhage [16-19]. A reasonable approach is to type and screen women at moderate risk of needing a transfusion (eg, multiple gestation, trial of labor after cesarean, preeclampsia/HELLP [Hemolysis, Elevated Liver enzymes, Low Platelet count] without coagulopathy, grand multiparity, intraamniotic infection, large fibroids) and type and crossmatch women at high risk of needing a transfusion (eg, placenta previa or accreta, preeclampsia/HELLP with coagulopathy, severe anemia, congenital or acquired bleeding diathesis) [20]. Holding a clot may be sufficient for women at low risk of hemorrhage.

- **Human immunodeficiency virus (HIV)** – Women who have not had HIV screening in pregnancy or whose HIV status is undocumented should be offered rapid HIV testing in labor [21,22]. Some states require all women be screened at delivery. If the rapid test is positive, then antiretroviral prophylaxis should be initiated while waiting for the results of confirmatory testing. (See "Prenatal evaluation of the HIV-infected woman in resource-rich settings" and "Antiretroviral and intrapartum management of pregnant HIV-infected women and their infants in resource-rich settings".)

- **Hepatitis B** – Women who were not screened for hepatitis B surface antigen prenatally, or engage in behaviors that put them at high risk for infection (eg, having had more than one sex partner in the previous six months, evaluation or treatment for a sexually transmitted infection, recent or current injection-drug use, a hepatitis B antigen-positive sex partner), or have clinical hepatitis should be tested at hospital admission for delivery [21]. Some states require all women be screened at delivery. The infant should receive immunoprophylaxis if the results are positive. (See "Hepatitis B virus immunization in infants, children, and adolescents", section on 'HBsAg-positive mother'.)

- **Syphilis** – Women who are at high risk for syphilis, live in areas of high syphilis morbidity, or are previously untested should be screened at delivery [21]. Some states require all women be screened at delivery. (See "Syphilis in pregnancy".)

- **Group B streptococcus** – Women with unknown group B streptococcus (GBS) status can be tested with a nucleic acid amplification tests (NAAT), such as polymerase chain reaction for GBS, where available. However, such testing is less reliable than routine GBS screening at 35 to 37 weeks. Chemoprophylaxis is indicated if NAAT is positive, or if the GBS carrier status is unknown but intrapartum risk factors for early-onset GBS infection develop (delivery at <37 weeks gestation, temperature ≥100.4ºF [≥38.0ºC] or rupture of amniotic membranes ≥18

hours). (See "Neonatal group B streptococcal disease: Prevention", section on 'Rapid diagnostic tests'.)

Patient preparation — Meta-analyses of randomized trials support avoidance of routine enemas and perineal shaving as these interventions are not beneficial and have bothersome or harmful side effects [23,24]. Women can be encouraged to empty their bladder regularly; a urinary catheter is unnecessary unless the woman is unable to void. Available data suggest that bladder distention does not affect labor progress [25,26].

Fluids and oral intake — Historically, oral intake has been restricted during active labor because of the risk of aspiration pneumonitis, a major cause of anesthetic-associated morbidity and mortality. However, this risk is very low in the current era and restriction of oral intake can lead to dehydration and ketosis. We allow clear liquids to women at low risk of cesarean delivery, but restrict consumption of solid foods in accord with guidelines by the American College of Obstetricians and Gynecologists and the American Society of Anesthesiologists Task Force on Obstetric Anesthesia that recommend avoidance of solid foods in laboring women [27,28].

We provide maintenance intravenous fluids with 5 percent dextrose or 5 percent dextrose in 0.45 percent saline if oral intake is inadequate [29,30]. Glucose requirements in labor are analogous to the requirement observed with sustained and vigorous exercise. Intrapartum administration of glucose may also be important for optimal myometrial function [29], although a clear effect on progress of labor has not been reported [29,31].

Dehydration adversely affects exercise performance and may be a factor contributing to longer duration of labor. Physiologists have shown that hydration improves skeletal muscle performance during prolonged exercise; however, the effects of hydration on smooth muscle are less clear [32,33]. Among nulliparous women not allowed oral intake during labor, a meta-analysis of two randomized trials found that the duration of labor may be shortened by administration of intravenous fluids at a rate of 250 mL/hour rather than 125 mL/hour [31].

When oral intake is not restricted, the benefit of dextrose-containing intravenous fluids is less clear. A 2017 systematic review of 10 randomized trials comparing less-restrictive food intake policies with more restrictive food intake policies during labor in women with low-risk singleton pregnancies found that less restrictive policies resulted in a slightly shorter duration of labor (-7 to -25 minutes) [34]. No other benefits or harms were noted; however, a key outcome, aspiration rate, could not be assessed because no events occurred. Maternal satisfaction was also not assessed.

Antacids — We do not routinely administer sodium citrate to our laboring patients, but give it to all patients before cesarean delivery. Some authors have suggested administering a clear antacid (eg, 10 to 30 mL sodium citrate) to all laboring women since aspiration pneumonitis results from the acidity of the aspirated gastric contents; however, the utility of this approach in laboring women has not been proven [35].

Medication management — Women can take their usual daily medications orally during labor; however, gastric absorption is unpredictable if labor is advanced. If this is a clinically important concern, an alternate route of administration is preferable.

Women who have been taking glucocorticoids in a dose equivalent to prednisone 5 to 20 mg daily for more than three weeks may have hypothalamic-pituitary-adrenal axis suppression and either should undergo testing or receive empiric glucocorticoid coverage. Perioperative management of

specific medications, including glucocorticoid coverage, is reviewed separately. (See "Perioperative medication management".)

Infection prophylaxis

Systemic antibiotics — Intrapartum chemoprophylaxis to prevent early-onset neonatal GBS infection is indicated for patients who meet standard criteria; the agent of choice is intravenous penicillin. A minimum of four hours of intrapartum therapy has been recommended prior to delivery; however, bactericidal levels in cord blood are achieved within 30 minutes of administration to the mother so antibiotics should be administered even if delivery seems imminent. (See "Neonatal group B streptococcal disease: Prevention".)

Vaginal delivery is not an indication for routine antibiotic prophylaxis, even in women with cardiac lesions, since the rate of bacteremia is low. This issue is discussed in more detail separately. (See "Antimicrobial prophylaxis for bacterial endocarditis", section on 'Vaginal or cesarean delivery'.)

Vaginal antiseptic antibacterial agents — Available data provide no convincing evidence to support the practice of intrapartum chlorhexidine vaginal irrigation for reducing the risk of maternal and neonatal infection [36].

Maternal activity and position — Maternal preferences can guide maternal activity. In a randomized trial, walking during the first stage did not enhance or impair active labor and had no harmful effects [37].

Laboring women should assume positions that are comfortable [38,39], unless specific positions are needed because of maternal-fetal status and need for close monitoring. Data from randomized trials provide no strong evidence to discourage maternal preference for choosing position during labor.

In a 2013 meta-analysis including 25 trials (5218 women), the duration of the first stage was more than one hour shorter in women randomly assigned to upright positions (standing, sitting, kneeling, walking around) than in those randomly assigned to recumbent positions or bed care (-1.36 hours, 95% CI -2.22 to -0.51 hours) and women in upright positions had a modest reduction in cesarean delivery (relative risk [RR] 0.71, 95% CI 0.54-0.94), but there were no statistical differences in use of oxytocin augmentation (RR 0.89, 95% CI 0.76-1.05), maternal pain requiring analgesia (RR 0.95, 95% CI 0.84-1.08), or duration of the second stage (-3.71 minutes, 95% CI -9.37-1.94 minutes) [38]. Some limitations of these trials include risk of bias since blinding was not possible and wide variation in the patients' positions and time spent in various positions.

A 2017 meta-analysis of five randomized trials on the effect of upright versus recumbent position in the second stage of labor in women with epidural analgesia found no conclusive evidence that position affected the rate of operative delivery, duration of the second stage, or any other maternal or fetal outcome [39].

Pain control and comfort measures — Multiple nonpharmacologic, pharmacologic, and anesthetic options are available to help women manage pain during labor. Use of nonpharmacologic measures can reduce the use of drugs during labor and may have a modest favorable effect on duration of labor. These options are reviewed in detail separately. (See "Nonpharmacologic approaches to management of labor pain" and "Pharmacologic management of pain during labor and delivery" and "Neuraxial analgesia for labor and delivery (including instrumented delivery)".)

Amniotomy — We do not perform amniotomy routinely as there is no convincing evidence of benefit in spontaneously laboring women. Rupture of membranes increases the risk of ascending infection and cord prolapse. In a 2013 systematic review and meta-analysis of randomized trials, routine amniotomy did not shorten the first or second stage of labor or reduce the rate of cesarean delivery compared with planned preservation of intact membranes (15 randomized trials involving over 5500 women) [40]. A limitation of this analysis was the lack of consistency in the timing of amniotomy with respect to cervical dilation and substantial crossover: 20 to 60 percent of women assigned to the control group underwent amniotomy at some stage in their labor. Although amniotomy allows assessment of meconium passage, this information alone has poor prognostic value and does not affect labor management [41,42].

Women undergoing augmentation or induction of labor may benefit from the combination of oxytocin administration and amniotomy (see "Induction of labor", section on 'Amniotomy'). If amniotomy is performed in women with polyhydramnios or an unengaged presenting part, we suggest using a small gauge needle (rather than a hook) to puncture the fetal membranes in one or more places and performing the procedure in an operating room. "Controlled amniotomy" minimizes the risk of gushing amniotic fluid and permits emergency cesarean delivery in the event of an umbilical cord prolapse. (See "Umbilical cord prolapse".)

Amniotomy should be avoided, if possible, in women with active hepatitis B, hepatitis C, or HIV infection to minimize exposing the fetus to ascending infection. Positive GBS carrier status is not a contraindication to amniotomy, if indicated.

Monitoring — Frequent maternal-fetal assessment is important as intrapartum complications can arise rapidly even in low-risk women: 20 to 25 percent of all perinatal morbidity and mortality occurs in pregnancies with no underlying risk factors for adverse outcome [43] and a study of 10 million birth certificates in the United States found that 29 percent of low-risk pregnancies had at least one unexpected complication that would require non-routine obstetric or neonatal care [44].

Fetal heart rate — Although controversial, intrapartum electronic FHR monitoring has become the most common obstetric procedure for women in the United States because patients and clinicians are reassured by normal results and believe there is some value in detecting abnormal FHR patterns. In women with pregnancies at increased risk of fetal compromise during labor (eg, suspected fetal growth restriction, preeclampsia, abruptio placenta, type 1 diabetes), we perform continuous electronic FHR monitoring, in agreement with clinical management guidelines from the American College of Obstetricians and Gynecologists [45]. We also monitor low-risk pregnancies continuously because it is more practical than intermittent monitoring in terms of nursing staff resources, but we are not rigid about this if the patient understands the risks and benefits of intermittent monitoring and has an uncomplicated pregnancy, normal FHR tracing, and is not resting in bed. Intrapartum FHR monitoring is reviewed in detail separately. (See "Intrapartum fetal heart rate assessment".)

Electronic FHR monitoring requires ongoing clinical assessment. At a minimum, the American College of Obstetricians and Gynecologists suggests review of FHR tracings in low-risk pregnancies every 30 minutes in the first stage of labor and every 15 minutes in the second stage [45]. For higher-risk pregnancies, they suggest reviewing the tracing every 15 minutes in the first stage and every five minutes in the second stage. Closer assessment and intervention may be indicated when abnormalities are identified. (See "Management of intrapartum category I, II, and III fetal heart rate tracings".)

The healthcare provider's interpretation of the tracing should be documented in the patient's medical record and should include a description of the uterine contractions, baseline FHR rate, baseline FHR variability, presence or absence of accelerations, presence or absence of periodic decelerations (ie, with contractions) or episodic decelerations (ie, unrelated to contractions), and changes in the FHR over time.

Uterine contractions — The frequency of contractions is documented as the number of contractions over a 30-minute period divided by three to give the number of contractions per 10 minutes. If this number is not a whole number, it may be rounded. Tachysystole is defined as >5 contractions per 10 minutes; any number greater than 5 (eg, 5.2) should be interpreted as tachysystole. Information about contraction frequency, duration, and strength can help the clinician determine the cause of abnormal labor progression and interpret abnormal FHR patterns. (See "Normal and abnormal labor progression" and "Management of intrapartum category I, II, and III fetal heart rate tracings" and "Induction of labor".)

External tocodynamometry is a noninvasive means for recording contraction frequency and duration, and provides adequate information for most labors. If the tracing is inadequate, an internal pressure transducer can be placed to measure contraction frequency, duration, and strength. (See "Use of intrauterine pressure catheters".)

Labor progress — Few randomized trials have evaluated the optimum frequency and timing of intrapartum vaginal examination of the cervix, fetal position, and fetal descent [46]. In most women, we perform vaginal examinations:

- On admission
- At four-hour intervals in the first stage
- Prior to administering analgesia/anesthesia
- When the parturient feels the urge to push (to determine whether the cervix is fully dilated)
- At two-hour intervals in the second stage
- If FHR abnormalities occur (to evaluate for complications such as cord prolapse or uterine rupture)

The number of examinations is kept to a minimum for patient comfort and to minimize iatrogenically exposing the fetus to vaginal flora. (See "Intra-amniotic infection (clinical chorioamnionitis or triple I)", section on 'Risk factors'.)

Assessing whether labor is progressing normally is a key component of intrapartum care; however, determining the onset of labor, measuring its progress, and evaluating the factors (power, passenger, pelvis) that affect its course is an inexact science. Criteria for normal and abnormal progress and management of protracted labor are discussed in detail separately. (See "Normal and abnormal labor progression".)

Precipitate or precipitous labor and delivery refers to a rapid labor and delivery of the fetus, variously defined as expulsion of the fetus within two to three hours of commencement of contractions [20,21]. It is rare and not well-studied.

MANAGEMENT OF THE SECOND STAGE OF LABOR

Persistent anterior cervical lip — In most women, the final centimeter of cervix anteriorly between the pelvic brim and the fetal head rapidly disappears as the cervix fully dilates and the fetal head descends. Occasionally an anterior lip persists for >30 minutes and may indicate malposition or a labor abnormality, especially if the lip becomes edematous.

We manage these patients expectantly and avoid manually reducing the anterior lip because of the risk of lacerating the cervix and hemorrhage. However, with prolonged expectant management, cervical laceration, necrosis, or detachment of the lip may occur spontaneously. If manual reduction is attempted, the cervical lip is pushed backwards during a contraction until it slips over the fetal head and above the interior border of the symphysis pubis [47]. The cervix is gently held in this position until the fetal head descends with the next contraction and maternal pushing.

Perineal care — Application of warm compresses and perineal massage with a lubricant have been proposed as means of softening and stretching the perineum to reduce perineal trauma during birth. In a meta-analysis of randomized trials, applying warm compresses during the second stage of labor reduced third- and fourth-degree tears compared with a hands off or no warm compress technique (RR 0.48, 95% CI 0.28-0.84; two trials, n = 1525 women); performing massage also reduced third- and fourth-degree tears compared with hands off/usual care (RR 0.52, 95% CI 0.29-0.94 (two trials, n = 2147 women) [48]. Antepartum perineal massage may also be helpful [49].

Although not harmful, we do not routinely advise antenatal perineal massage, perform second stage perineal massage, or apply warm compresses as available trials suggesting a benefit have major methodologic limitations due to lack of blinding, differences in the provision of usual care, and inability to address the importance of other factors related to perineal injury [48,49].

If used, warm compresses can be made from clean wash cloths or perineal pads immersed in warm tap water (up to 110 degrees Fahrenheit [43 degrees Celsius]) and wrung to release excess water [50,51]. They are held against the mother's perineum during and between pushes, and changed as needed to maintain warmth and cleanliness. Perineal massage is performed during and between pushes with two fingers of the lubricated gloved hand moving from side to side just inside the patient's vagina and exerting mild, downward pressure.

Pushing — Most women begin pushing when the cervix is fully dilated. However, if the FHR tracing is normal and station is high, we often ask women to delay pushing until the further descent has occurred to reduce the duration of time of maximal maternal exertion (ie, "laboring down"). This decision is based on patient-specific factors, such as whether there is a need to expedite delivery, maternal fatigue, and maternal preference. There are no strong data that one approach is better than another.

We have the patient push in the position she finds most comfortable. There is no convincing evidence of an optimal maternal position for pushing [52,53]. Upright positions, including kneeling and sitting, have several theoretical benefits (eg, increase in pelvic dimensions, good fetal alignment) and the supine position should be avoided because of aortocaval compression.

The optimum pushing technique is also unclear. We favor allowing the woman to bear down when she feels the need (ie, spontaneous pushing or physiologic pushing), unless epidural anesthesia has inhibited the bearing down sensation. We advise against Valsalva pushing (pushing with a closed glottis), as there is no clinically significant benefit to this technique [54]. Women are typically told to pull back their knees, tuck in their chin, take a deep breath, bear down at the start

of a contraction, and push for 10 seconds with the goal of three pushes per contraction. However, there is no evidence that coaching women in this way has any benefit over allowing them to bear down and push according to their own reflex needs in response to the pain of contractions and the pressure felt from descent of the fetal head [54].

A 2017 meta-analysis of pooled data from 21 randomized trials of different approaches to pushing reported the following major findings [55]:

- No clear difference in the length of the second stage or duration of pushing when women follow their own instincts about breathing while pushing (spontaneous pushing) versus asking them to take a deep breath at the beginning of a contraction and holding the breath as long as possible while bearing down (directed pushing with Valsalva maneuver)
- In women with epidural analgesia, delayed pushing lengthened the second stage by about one hour and decreased pushing duration by a mean of 19 minutes compared with immediate pushing. It also slightly increased the chance of a spontaneous vaginal delivery (RR 1.07; 95% CI 1.02-1.11). Although the frequency of low umbilical cord blood pH increased (RR 2.24; 95% CI 1.37-3.68), no differences were observed in rates of admission to the neonatal intensive care or five-minute Apgar score less than seven.
- Pushing technique (spontaneous, directed, immediate, delayed, posture) did not appear to have a major impact on the occurrence of adverse maternal or neonatal outcomes.

Duration — As long as the FHR pattern is normal and some degree of progress is observed, there is no strict upper limit to the duration of the second stage (ie, time from full dilation to birth). There is no threshold at which maternal or neonatal outcomes abruptly worsen, but a second stage lasting longer than four hours in nulliparas and two hours in multiparas appears to be associated with a small increase in frequency of maternal and potentially serious neonatal complications, and this is concerning.

In a prospective study including over 53,000 women at term with singleton cephalic gestations, 78 percent of nulliparas and 82 percent of multiparas who continued to push longer these times achieved a vaginal delivery [56]. In nulliparas, the frequency of the neonatal composite adverse outcome at <60 minutes and ≥240 minutes was 1.3 and 2.4 percent, respectively. In parous women, the frequency of the neonatal composite adverse outcome at <60 minutes and ≥120 minutes was 1.1 and 2.8 percent, respectively. Of possible concern, seizures or hypoxia-ischemic encephalopathy accounted for almost all adverse neonatal outcomes at ≥240 minutes (10 newborns or 2.2 percent of the population pushing ≥240 minutes versus 0.4 percent of the population pushing <60 minutes). An increase in neonatal seizures and hypoxia-ischemic encephalopathy at ≥120 minutes was also noted in parous women (seven newborns or 1.5 percent of the population pushing ≥120 minutes versus 0.2 percent of the population pushing <60 minutes). (See "Normal and abnormal labor progression".)

Maternal position for delivery — If no fetal manipulation or complications are anticipated, delivery can be accomplished with the mother in almost any position that she finds comfortable [39,52]. Common positions include the lateral (Sims) position and the partial sitting position. Stirrups are not mandatory [57]. The lithotomy position is advantageous if fetal manipulation or need for optimal surgical exposure is anticipated.

The second stage appears to be shortened by a few minutes in women without epidural anesthesia who birth in an upright position [52]. Maternal birth position does not appear to have a significant effect on risk of third and fourth degree lacerations [39,52].

Episiotomy — Routine use of episiotomy is not beneficial and should be avoided. Episiotomy is reserved for deliveries with a high risk of severe perineal laceration, significant soft tissue dystocia, or need to facilitate delivery of a possibly compromised fetus. (See "Approach to episiotomy".)

Delivery of the newborn — The procedure for spontaneous vaginal delivery is described below. Operative vaginal and abdominal delivery are reviewed separately. (See "Operative vaginal delivery" and "Cesarean delivery: Technique".)

The responsibilities of the healthcare provider at delivery are to reduce the risks of maternal perineal trauma and fetal injury during delivery and provide initial support of the newborn. There is no consensus regarding the best method for protecting the perineum at delivery [50,51,58-65], other than avoiding routine episiotomy and fundal pressure [66]. Options include delivering the fetus between contractions versus during a contraction, and various methods of using the accoucheur's hands to control delivery of the fetal head. The latter may involve no touch (“hands-off”), passive perineal support, support of the fetal crown, and using fingers placed between the maternal anus and coccyx to actively lift the fetal chin anteriorly (ie, Ritgen maneuver). Warm compresses and perineal massage may be helpful to reduce perineal trauma. (See 'Perineal care' above.)

We use the following approach (called the “hands-on” technique) to prevent precipitous expulsion of the newborn, which can lacerate the perineum and anal sphincter [58,65,67]. We ask the woman to pant or make only small expulsive efforts when the head is fully crowning and delivery is imminent; this prevents the head from being propelled through the perineum. We use one hand to maintain the head in a flexed position and control the speed of crowning and use the other hand to ease the perineum over the head. Some providers support the perineum with a sponge, applying medial pressure [48]. Once the fetal head delivers, external rotation (restitution) occurs spontaneously (figure 8). A meta-analysis of three trials that evaluated manual perineal support found that it did not significantly reduce obstetrical anal sphincter injuries (OASIS) (RR, 1.03, 95% CI 0.32–3.36), although three nonrandomized studies suggested a benefit (RR 0.45, 95% CI 0.40–0.50). Since the techniques for perineal support were not well described, it is difficult to interpret these findings. The role of various obstetric factors on anal sphincter injury and postpartum function are discussed separately. (See "Effect of pregnancy and childbirth on anal sphincter function and fecal incontinence".)

If the cord is around the neck (nuchal cord), slipping the cord over the head usually successfully frees the fetus from the tether. If a single nuchal cord is not reducible, we doubly clamp and transect it. Other options for a cord that is difficult to reduce but not tight include slipping it over the shoulders and delivering the body through the loop, and delivering the body without reducing the cord (somersault maneuver). (See "Nuchal cord", section on 'Delivery'.)

Mucus is gently wiped from the newborn's nose and mouth. Most newborns do not need to be suctioned. (See 'Oropharyngeal care' below.)

After delivering the head, a hand is placed on each side of the head and the anterior shoulder is delivered with the next contraction, using gentle downward traction toward the mother's sacrum in concert with maternal expulsive efforts. In this way, the anterior shoulder is guided under the symphysis pubis. The posterior shoulder is then delivered by upward traction. These movements

should be performed with as little downward or upward force as possible to avoid perineal injury and/or traction injuries to the brachial plexus. The delivery is then completed, either spontaneously or with a gentle maternal push.

Oropharyngeal care — There is no evidence that oro-nasopharyngeal suctioning by a bulb or catheter is beneficial in healthy term newborns [68-72] and, in some studies, suctioning slightly reduced neonatal oxygen saturation in the first few minutes of life [68,71,72]. However, suctioning immediately after birth is appropriate for newborns with obvious obstruction to spontaneous breathing due to secretions or who are likely to require positive-pressure ventilation. The mouth is suctioned first and then the nares to decrease the risk for aspiration (newborns are obligate nose breathers). Suctioning of the posterior pharynx should be avoided, as it can stimulate a vagal response, resulting in apnea and/or bradycardia. In a randomized equivalency trial, wiping the face, mouth, and nose with a towel was equivalent to suction with a bulb syringe [73]. The trial's primary endpoint was mean respiratory rate within the first 24 hours after birth; neonates who were non-vigorous or born with meconium stained amniotic fluid were excluded. (See "Overview of the routine management of the healthy newborn infant", section on 'Delivery room care' and "Neonatal resuscitation in the delivery room", section on 'Airway'.)

Meconium — The American Heart Association, the American Academy of Pediatrics, and the American College of Obstetricians and Gynecologists (ACOG) recommend against routine nasopharyngeal suctioning of meconium-stained newborns [74,75]. Randomized trials have demonstrated that this approach does not decrease meconium aspiration syndrome or improve perinatal outcome [76]. (See "Prevention and management of meconium aspiration syndrome".)

Cord clamping — We agree with an ACOG committee opinion that recommends delaying umbilical cord clamping for at least 30 to 60 seconds after birth in vigorous term and preterm infants [77].

Although the optimal amount of time before cord clamping has not been studied extensively, we believe data support a minimum duration of delay of at least one minute in term births and 30 seconds in preterm births [78]. Others have suggested waiting two to five minutes in healthy term births before clamping the cord (or longer if the mother requests) and at least one minute in healthy preterm births (or longer if the mother requests) [79].

Approximately 75 percent of blood available for placenta-to-fetus transfusion is transfused in the first minute after birth [80]. Delaying cord clamping increases the volume of placental blood transfused to the fetus and thereby increases neonatal blood volume, improves neonatal and infant iron stores, and decreases neonatal and infant anemia. It also facilitates the fetal to neonatal transition. Clamping the cord before initiation of spontaneous respirations (mean onset of respiration is 10±15 seconds after expulsion [81]) appears to adversely affect cardiovascular hemodynamics during the fetal to neonatal transition, likely due to removal of umbilical venous return before dilation of the pulmonary vascular bed [82-85]. Lung aeration triggers an increase in pulmonary blood flow, which supplies most of the preload to the left ventricle; if cord clamping precedes onset of respiration, ventricular preload falls because the loss of umbilical venous return is not balanced by an increase in pulmonary venous return [85]. This may partially account for some of the non-hematologic benefits reported in trials of delayed cord clamping [86].

In term newborns, the main advantage of delayed cord clamping is higher infant iron stores at six months of age, which may be particularly advantageous when the mother has a low ferritin level or plans to breastfeed without supplementing with iron or fortified formula. In preterm infants, the

significant reductions in intraventricular hemorrhage and necrotizing enterocolitis associated with delayed cord clamping are sufficiently compelling to adopt this intervention.

Delaying cord clamping should not interfere with timely care of the newborn and should never compromise the safety of the mother or newborn. For example, it is not appropriate when the mother or newborn is unstable or when the newborn-placental circulation is not intact (eg, abruption, previa, cord avulsion). It may not be appropriate in cases of fetal growth restriction with abnormal umbilical artery Doppler studies as these newborns may already have polycythemia and hyperviscosity.

Disadvantages of delayed cord clamping include an increase in hyperbilirubinemia in the immediate newborn period resulting in more phototherapy and an increased risk of polycythemia in growth-restricted neonates. Delaying cord clamping also reduces the volume of umbilical cord blood available for harvesting stem cells; thus the size and cell dose of collected cord blood units may not be adequate for a future hematopoietic cell transplant if cord clamping is delayed. This should be considered when cord blood collection is planned for this purpose. (See "Collection and storage of umbilical cord blood for hematopoietic cell transplantation".)

The following data support our approach:

- **Term infants** – A 2013 meta-analysis of 15 randomized trials including 3911 mothers and their infants evaluated early versus late (two to three minutes after birth) cord clamping in term infants [87]. Compared with early cord clamping, late cord clamping resulted in higher neonatal hemoglobin levels at 24 to 48 hours after birth (mean difference 1.49 g/dL), but not in subsequent assessments, and a lower proportion of infants with iron deficiency at three to six months of age (14 percent of infants in the early clamping group versus 8 percent in the late clamping group). However, late cord clamping also resulted in a 40 percent increase in newborns needing phototherapy for jaundice (2.74 percent of infants in the early clamping group versus 4.36 percent in the late clamping group).

  In addition, the only randomized clinical trial that assessed the effects of delayed cord clamping compared with early cord clamping at four years of age reported a possible benefit in some neurodevelopmental outcomes, particularly in boys, and no harmful effects [88].

- **Preterm infants** – A 2012 meta-analysis of 15 randomized trials evaluated late versus early cord clamping in 738 preterm infants [89]. Compared with early cord clamping, late cord clamping resulted in fewer infants requiring transfusion for anemia (24 versus 36 percent; RR 0.61, 95% CI 0.46-0.81; seven trials, 392 infants), lower risk of necrotizing enterocolitis (21 versus 32 percent; RR 0.62, 95% CI 0.43-0.90; five trials, 241 infants), and fewer infants with any grade of intraventricular hemorrhage on ultrasound (14 versus 20 percent; RR 0.59, 95% CI 0.41-0.85; 10 trials, 539 infants). Peak bilirubin level was higher with delayed cord clamping, but the need for treatment of jaundice was not significantly increased.

  A 2014 meta-analysis restricted to randomized trials of interventions to promote placental transfusion (delayed cord clamping, cord milking) in pregnancies <32 weeks of gestation also reported significant neonatal benefits (reduced mortality, reduced rate of transfusion, reduced rate of intraventricular hemorrhage) [90]. There was also a strong trend toward higher peak bilirubin levels with the intervention.

Cord milking — We do not milk or strip the umbilical cord; however, this practice is an alternative to delayed clamping for enhancing blood transfusion. Depending on technique, cord milking may

be more efficient than delayed cord clamping for improving neonatal blood volume. A randomized trial in preterm infants found that milking the accessible length of the cord four times at a speed of 20 cm/2 seconds was equivalent to delaying cord clamping for 30 seconds [91].

Cord milking, like delayed cord clamping, may help stabilize blood pressure and increase urinary output in premature infants [92-94], but a theoretic concern is that a non-quantifiable amount of blood will be given to an immature infant in an uncontrolled fashion, which could be harmful. In a 2015 meta-analysis of seven randomized trials (n = 501 infants) of umbilical cord milking versus usual care, umbilical cord milking significantly increased hemoglobin levels without increasing the need for phototherapy for hyperbilirubinemia [95]. In the 277 infants <33 weeks, however, the need for blood transfusion was not reduced and the intervention did not significantly reduce mortality, hypotension requiring volume expanders or inotrope support, severe intraventricular hemorrhage, or necrotizing enterocolitis rates. These data do not provide convincing evidence for or against umbilical cord milking.

Delivery should not be unnecessarily delayed to milk the cord in situations where immediate pediatric assistance is needed, such as thick meconium or neonatal depression. Also, it should not be performed if cord blood collection is planned.

Cord blood — Cord blood collected for diagnostic purposes is usually obtained by allowing blood to drain from the cut end into a glass tube prior to delivery of the placenta, if possible. Cord blood may be tested for blood and Rhesus type or for a variety of newborn conditions, as indicated. Newborn screening programs typically use blood from a heel stick obtained as close to hospital discharge as possible to permit the maximum accumulation of abnormal compounds in the infant's blood and the best chance of obtaining a positive result if disease is present. (See "Newborn screening".)

When indicated because of neonatal depression, fetal blood for acid-base analysis is collected from an umbilical artery using a needle and syringe to minimize exposure to air and avoid mixing of arterial and venous blood. (See "Umbilical cord blood acid-base analysis at delivery".)

Collection of cord blood for banking can be performed with a needle and syringe before or after delivery of the placenta. The procedure for collection of umbilical cord blood for banking is reviewed separately. (See "Collection and storage of umbilical cord blood for hematopoietic cell transplantation".)

Maternal-newborn interaction — In the absence of maternal or neonatal complications, a healthy term infant can be dried to minimize heat loss and given to the mother. Skin-to-skin contact may benefit early mother-infant attachment and breastfeeding outcomes [96]. The location of the newborn (above or below the level of the placenta) before cord clamping did not appear to significantly affect the volume of placenta-to-newborn transfusion in a randomized trial [97]. Therefore, concerns about transfusion volume should not influence the decision to place the newborn on the mother's abdomen.

MANAGEMENT OF THE THIRD STAGE OF LABOR

Normal placental separation — Myometrial thickening after delivery of the infant leads to substantial reduction in uterine surface area, resulting in shearing forces at the placental attachment site and placental separation. This process generally begins at the lower pole of the placental margin and progresses along adjacent sites of placental attachment. A "wave of separation" spreads upward so that the uppermost part of the placenta detaches last [98,99].

Signs of placental separation include a gush of blood, lengthening of the umbilical cord, and anterior-cephalad movement of the uterine fundus, which becomes firmer and globular after the placenta detaches. Placental expulsion follows separation as a result of a combination of events including spontaneous uterine contractions, downward pressure from the developing retroplacental hematoma, and an increase in maternal intraabdominal pressure.

There is no universally accepted criterion for the normal length of the third stage. In two large series of consecutive deliveries, the average length was five to six minutes, 90 percent of placentas were delivered within 15 minutes, and 97 percent were delivered within 30 minutes of birth [100,101]. Gestational age is the major factor influencing the length of the third stage: Preterm deliveries are associated with a longer third stage than term deliveries [100-103].

Active management and delivery of the placenta — We actively manage the third stage because active management reduced the risk of severe postpartum blood loss and blood transfusion compared with expectant management in randomized trials [104]. (See "Pharmacologic management of the third stage of labor", section on 'Active management'.)

Active management generally consists of prophylactic administration of an uterotonic agent before delivery of the placenta plus controlled traction of the umbilical cord after cord clamping and transection; uterine massage also may be performed. Randomized trials have demonstrated that the uterotonic agent is the most important component of this regimen [105-107]; we use oxytocin. (See "Pharmacologic management of the third stage of labor", section on 'Oxytocin'.)

We use controlled cord traction to facilitate separation and delivery of the placenta. In a 2014 meta-analysis of randomized trials comparing controlled cord traction with a hands-off approach, controlled cord traction resulted in a reduced need for manual removal of the placenta (relative risk [RR] 0.70, 95% CI 0.58-0.84), as well as small statistical reductions in the duration of the third stage (three minutes), mean blood loss (10 mL), and incidence of postpartum hemorrhage (11.8 versus 12.7 percent; RR 0.93, 95% CI 0.87-0.99); the rates of severe postpartum hemorrhage, need for additional uterotonics, and blood transfusion were not statistically different [108]. Others have reported similar findings [109]. Although the benefits of controlled cord traction are small, there are no significant harms from the maneuver if performed gently without excessive traction, which can result in cord avulsion or uterine inversion.

Two maneuvers for cord traction have been described: the Brandt-Andrews maneuver (an abdominal hand secures the uterine fundus to prevent uterine inversion while the other hand exerts sustained downward traction on the umbilical cord) [110] and the Crede's maneuver (the cord is fixed with the lower hand while the uterine fundus is secured and sustained upward traction is applied using the abdominal hand). We prefer the Brandt-Andrews maneuver.

If the cord avulses before delivery of the placenta, we wait up to 30 minutes for spontaneous placental separation and expulsion with maternal pushing. While waiting, preparations are initiated in case manual removal of the placenta is needed. We intervene promptly if bleeding becomes heavy. (See "Retained placenta after vaginal birth", section on 'Management'.)

As the placenta emerges from the vagina, the membranes flow behind it. Slowly rotating the placenta in circles as it is delivered or grasping the membranes with a clamp helps prevent them from tearing and possibly being retained in the uterine cavity.

The placenta, umbilical cord, and fetal membranes should be systematically examined. The fetal side is assessed for any evidence of vessels coursing to the edge of the placenta and into the

membranes, suggestive of a succenturiate placental lobe. The number of vessels in the cord is recorded. (See "Gross examination of the placenta".)

Bleeding — Average blood loss at vaginally delivery is estimated to be <500 mL. Excessive bleeding may be related to atony, trauma, coagulopathy, placental abnormalities, or uterine inversion. A visual aid depicting known volumes of blood on common obstetric materials (eg, peri pad, bed pan, kidney basin, bed pad) can improve obstetric provider accuracy in blood loss estimation [111]. (See "Overview of postpartum hemorrhage" and "Management of postpartum hemorrhage at vaginal delivery" and "Puerperal uterine inversion".)

Repair of lacerations — The cervix, vagina, and perineum should be examined for evidence of birth injury. The major risk factors for third and fourth degree perineal lacerations are nulliparity, operative vaginal delivery, midline episiotomy, and delivery of a macrosomic newborn [112]. If a laceration is identified, its length and position should be noted and repair initiated with adequate analgesia (see "Repair of episiotomy and perineal lacerations associated with childbirth"). Failure to recognize and repair a rectal injury can lead to serious long-term morbidity, most notably fecal incontinence. We perform a rectal examination after perineal repair to palpate sutures inadvertently placed through the rectal mucosa into the rectal lumen. If identified, the authors take down the repair and resuture, although there is no clear evidence that transmucosal stitches increase the risk of fistula formation. (See "Effect of pregnancy and childbirth on anal sphincter function and fecal incontinence".)

POSTPARTUM ISSUES AND CARE — Postpartum issues and care, including care of the newborn, are reviewed separately. (See "Overview of postpartum care" and "Overview of the routine management of the healthy newborn infant".)

INFORMATION FOR PATIENTS — UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on “patient info” and the keyword(s) of interest.)

- Basics topics (see "Patient education: Labor and delivery (childbirth) (The Basics)" and "Patient education: How to tell when labor starts (The Basics)" and "Patient education: Managing pain during labor and delivery (The Basics)")

SUMMARY AND RECOMMENDATIONS

- Childbirth education classes inform women and their partners about what to expect during labor and birth and provide a foundation for developing personal plans for the birth experience. (See 'Preparation' above.)

- The goals of the initial examination of the parturient are to review her prenatal record for medical or obstetrical conditions that need to be addressed intrapartum, check for development of new disorders since the last prenatal visit, establish baseline cervical status

so that subsequent progress can be determined, and evaluate fetal status. (See 'Initial examination' above.)

- Results from the following laboratory tests should be available at delivery, but intrapartum assessment is not always necessary: hemoglobin/hematocrit, blood type and screen, human immunodeficiency virus (HIV), hepatitis B antigen, syphilis, rectovaginal group B streptococcus. (See 'Laboratory tests' above.)

  Women who have not had HIV screening or whose HIV status is undocumented should be offered rapid HIV testing in labor.

  We recommend not performing routine enemas (**Grade 1A**) and we suggest not routinely shaving the perineum (**Grade 2B**). (See 'Patient preparation' above.)

- There is no consensus on acceptable maternal oral intake or need for intravenous fluids during an uncomplicated labor. We allow patients at low risk of cesarean delivery to have clear liquids and we place an intravenous line or heparin lock for all women in labor. (See 'Fluids and oral intake' above.)

- Vaginal delivery is not an indication for routine antibiotic prophylaxis, even in women with cardiac lesions, since the rate of bacteremia is low. Intrapartum chemoprophylaxis to prevent early-onset neonatal GBS infection is indicated for patients who meet standard criteria; the agent of choice is intravenous penicillin. (See 'Systemic antibiotics' above and "Neonatal group B streptococcal disease: Prevention".)

- Maternal preferences can guide maternal activity. Walking during the first stage does not appear to enhance or impair labor progress. Laboring women should assume positions that are comfortable, unless specific positions are needed because of maternal-fetal status and need for close monitoring. (See 'Maternal activity and position' above.)

- Multiple nonpharmacologic, pharmacologic, and anesthetic options are available to help women manage pain during labor. (See "Nonpharmacologic approaches to management of labor pain" and "Pharmacologic management of pain during labor and delivery" and "Neuraxial analgesia for labor and delivery (including instrumented delivery)".)

- We suggest not performing amniotomy routinely (**Grade 2B**). There is no convincing evidence of benefit in spontaneously laboring women, and rupture of membranes increases the risk of ascending infection and cord prolapse. (See 'Amniotomy' above.)

- In women with pregnancies at increased risk of fetal compromise during labor, we perform continuous electronic fetal heart rate (FHR) monitoring, in agreement with clinical management guidelines from the American College of Obstetricians and Gynecologists. We also monitor low-risk pregnancies continuously because it is more practical than intermittent monitoring, but we are not rigid about this if the patient understands the risks and benefits of intermittent monitoring and has an uncomplicated pregnancy, normal FHR tracing, and is not resting in bed. Contractions and labor progress are also monitored. (See 'Monitoring' above.)

- The optimal pushing position technique, position, and duration are unclear. We suggest patients push in the position they find most comfortable and with an open glottis (**Grade 2C**). However, if the FHR tracing is normal and station is high, we often ask women to delay pushing until the further descent has occurred to reduce the duration of time of maximal maternal exertion. (See 'Pushing' above.)

- We recommend not performing episiotomy routinely (**Grade 1A**). (See "Approach to episiotomy".)
- We suggest a “hands-on” technique (**Grade 2C**). Preventing precipitous expulsion of the newborn can reduce the risk of obstetrical and anal sphincter injury. (See 'Delivery of the newborn' above.)
- Routine oro-nasopharyngeal suctioning of newborns by a bulb or catheter is not beneficial, including those with meconium-stained amniotic fluid. Suctioning is appropriate for newborns with obvious obstruction to spontaneous breathing or who are likely to require positive-pressure ventilation. (See 'Oropharyngeal care' above and 'Meconium' above.)
- In preterm births who do not require resuscitation, we recommend delayed cord clamping (**Grade 1B**). Benefits include reduced rates of transfusion, intraventricular hemorrhage, necrotizing enterocolitis, and hypotension. For term infants who do not require resuscitation, we suggest delayed cord clamping (**Grade 2C**). However, not routinely delaying cord clamping is also reasonable as the improvement in iron stores needs to be balanced with the disadvantage of an increased risk for hyperbilirubinemia and more need for phototherapy. We delay clamping at least 30 seconds in preterm infants and at least one minute in term infants. (See 'Cord clamping' above.)
- Cord milking is an alternative to cord clamping and results in more rapid blood transfusion when time is a factor. (See 'Cord milking' above.)
- Delaying cord clamping reduces the volume of umbilical cord blood available for harvesting stem cells; therefore, the size and cell dose of collected cord blood units may not be adequate for a future hematopoietic cell transplant if cord clamping is delayed. (See 'Cord clamping' above.)
- Active management of the third stage reduces maternal blood loss and risk of postpartum hemorrhage compared with expectant management. We administer oxytocin and apply controlled traction of the umbilical cord. The placenta should be examined to make sure it is intact. (See 'Active management and delivery of the placenta' above.)
- Average blood loss at vaginal delivery is estimated to be <500 mL. Excessive bleeding may be related to atony, trauma, coagulopathy, placental abnormalities, or uterine inversion. (See 'Bleeding' above.)
- Failure to recognize and repair a rectal injury can lead to serious long-term morbidity, most notably fecal incontinence. (See 'Repair of lacerations' above.)

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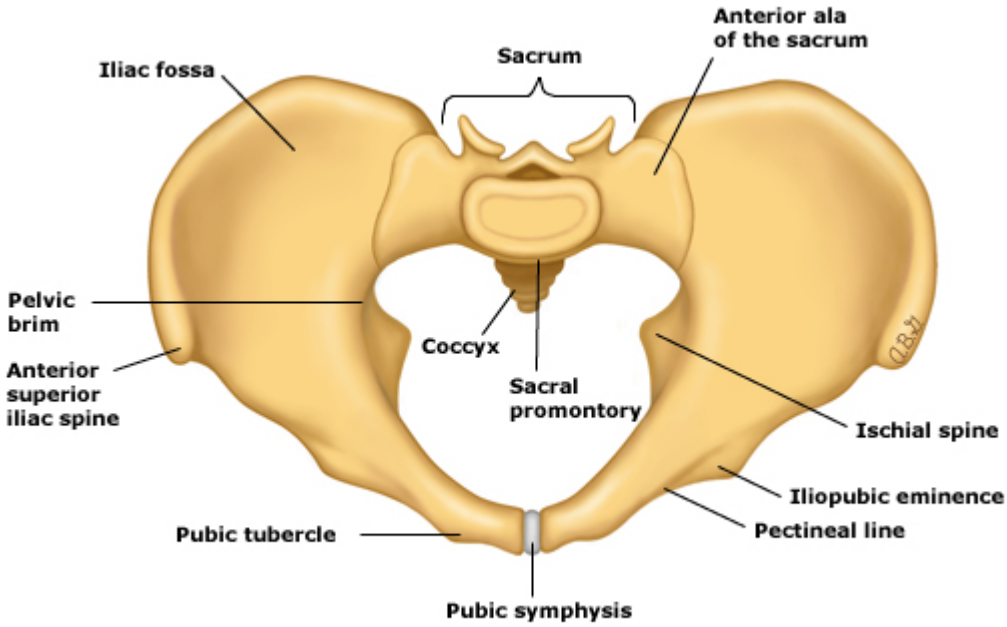
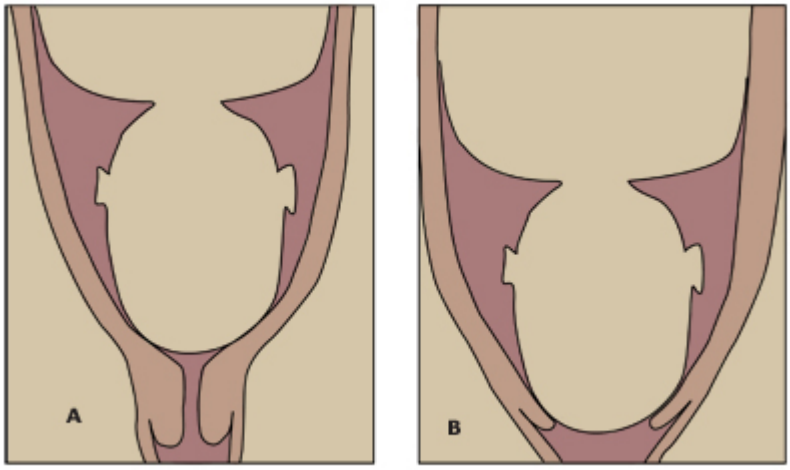
GRAPHICS

Superior view of female pelvis



Graphic 60078 Version 3.0

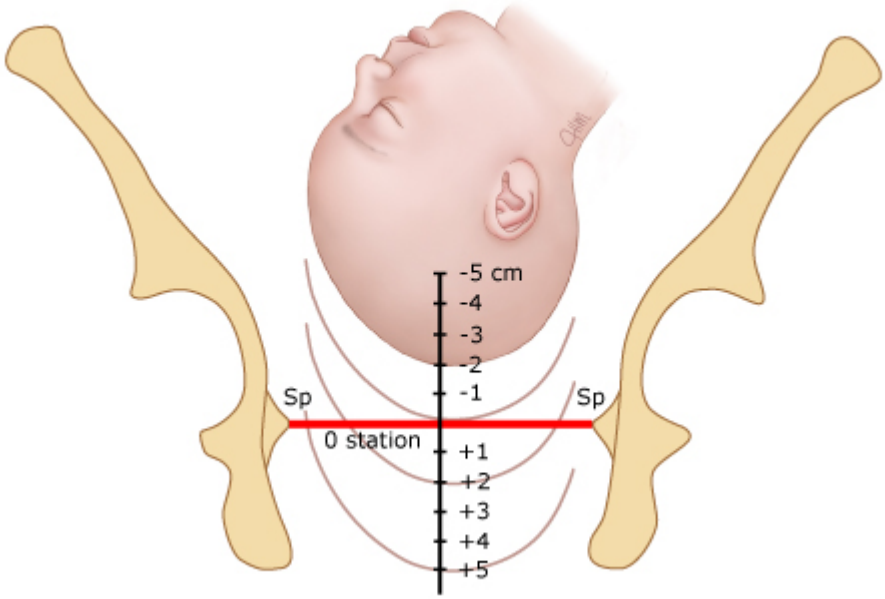
Effacement and dilatation of the cervix



(A) Cervix is uneffaced and minimally dilated.
(B) Cervix is almost completely effaced and dilated.

Graphic 58602 Version 3.0

Assessing descent of the fetal head by vaginal examination

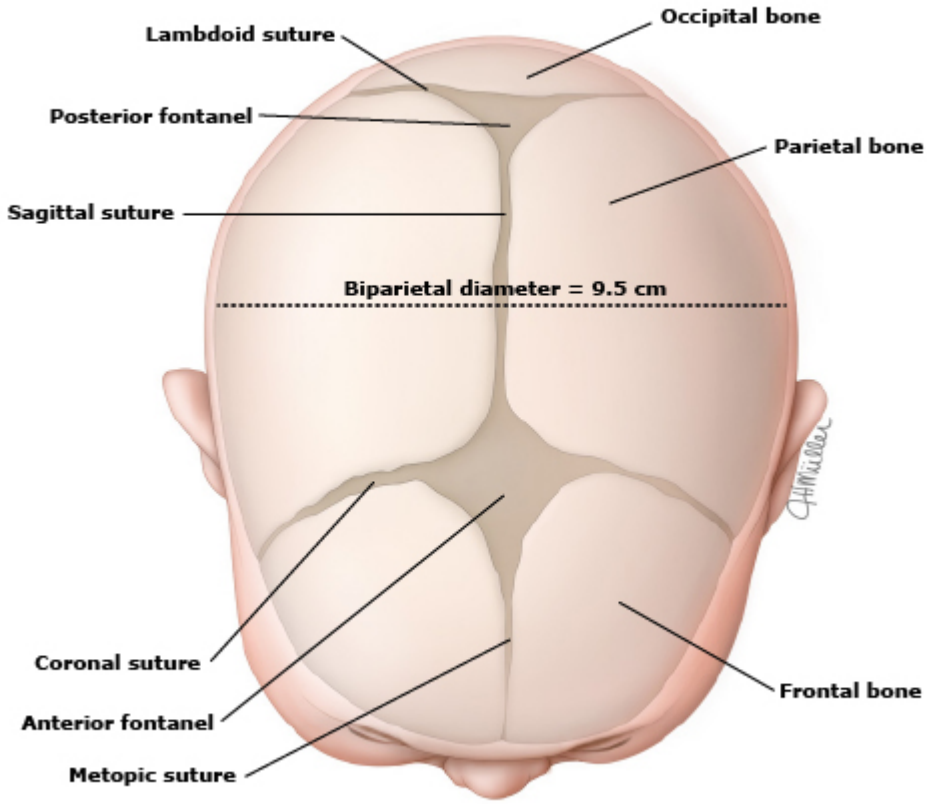


The fetus is at -2 station signifying that the leading bony edge of the presenting part is 2 centimeters above the ischial spines. The head is engaged at 0 station.

Sp: ischial spine.

Graphic 67068 Version 5.0

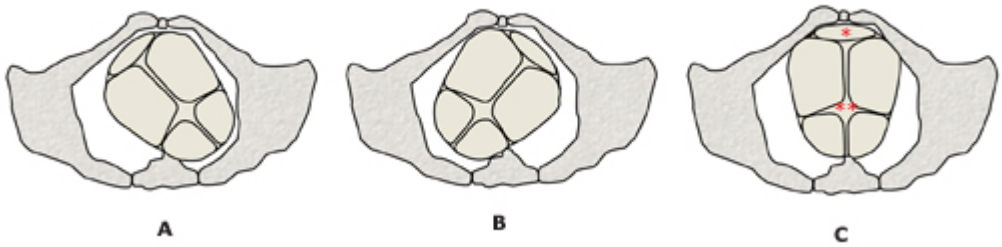
Fetal head at term showing fontanelles, sutures, and biparietal diameter



The anterior fontanelle is diamond shaped, at the intersection of four fetal skull bones, and usually the larger fontanelle, whereas the posterior fontanelle is triangular, at the intersection of three fetal skull bones, and usually the smaller fontanelle.

Graphic 81518 Version 10.0

Occiput anterior positions

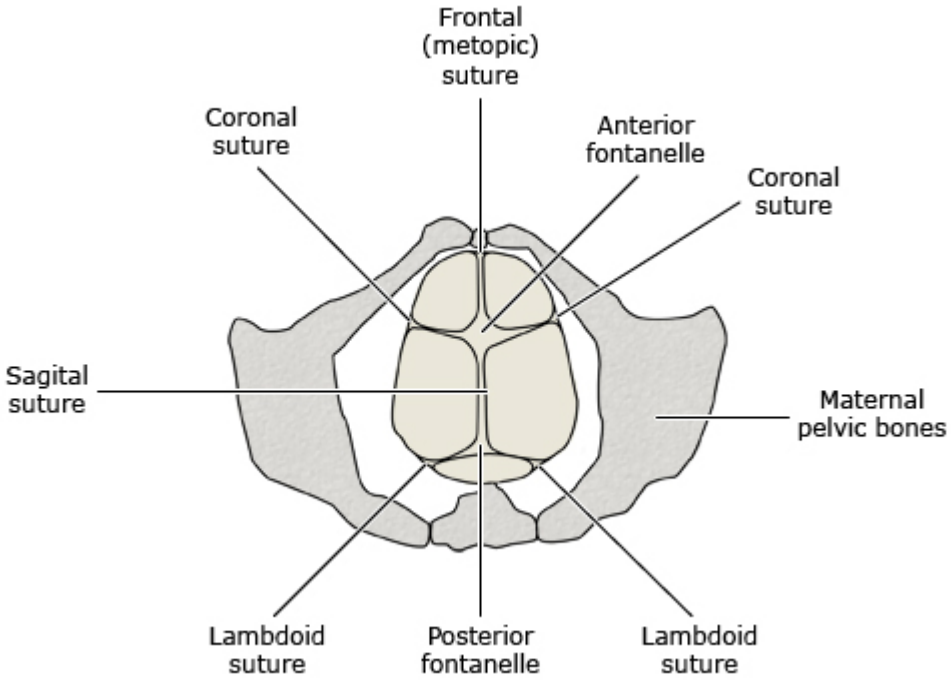


(A) Right occiput anterior (ROA).
(B) Left occiput anterior (LOA)
(C) Occiput anterior (OA).

* Posterior fontanel. This is the smaller of the two fontanels and is at the intersection of the three sutures: the sagittal suture and two lambdoid sutures.
** Anterior fontanel. This large fontanel is at the intersection of four sutures: the sagittal, frontal, and two coronal sutures.

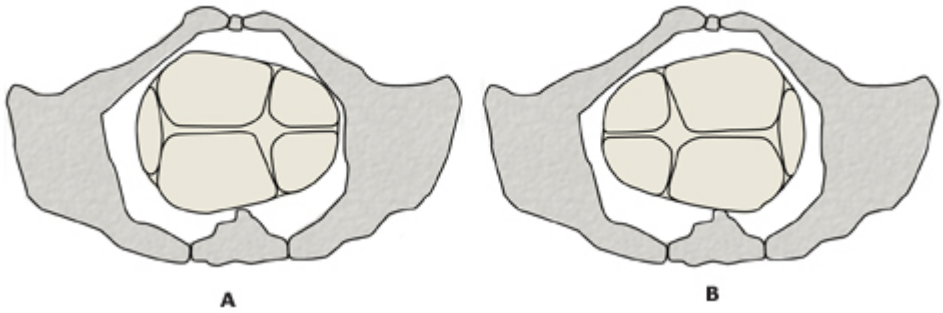
Graphic 63528 Version 3.0

Occiput posterior position



Graphic 73262 Version 3.0

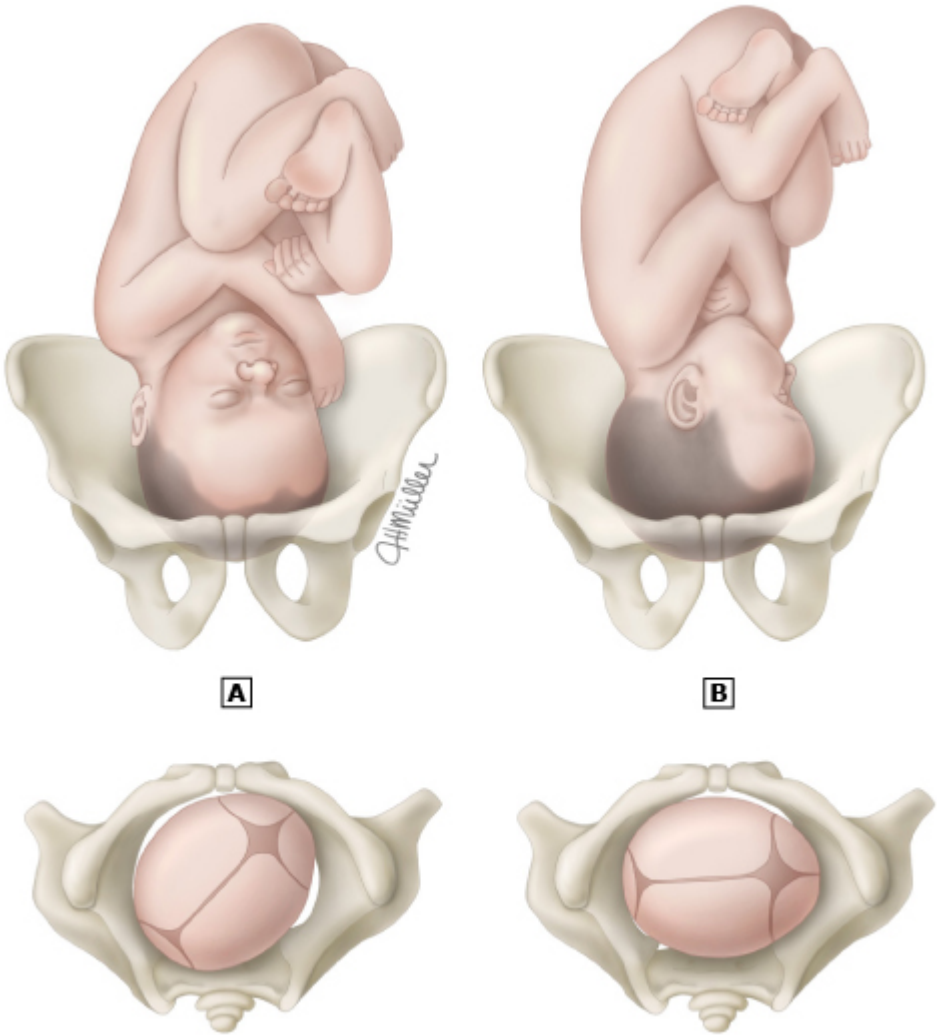
Occiput transverse positions



(A) Right occiput transverse (ROT).
(B) Left occiput transverse (LOT).

Graphic 52247 Version 3.0

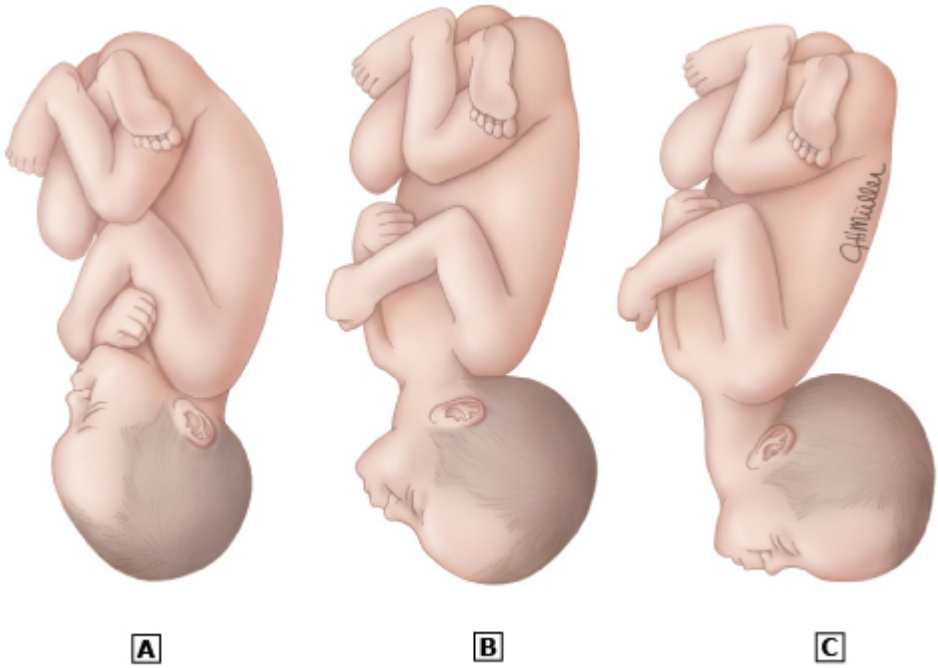
Occiput posterior and occiput transverse positions



(A) Right occiput posterior (ROP).
(B) Right occiput transverse (ROT).

Graphic 57241 Version 4.0

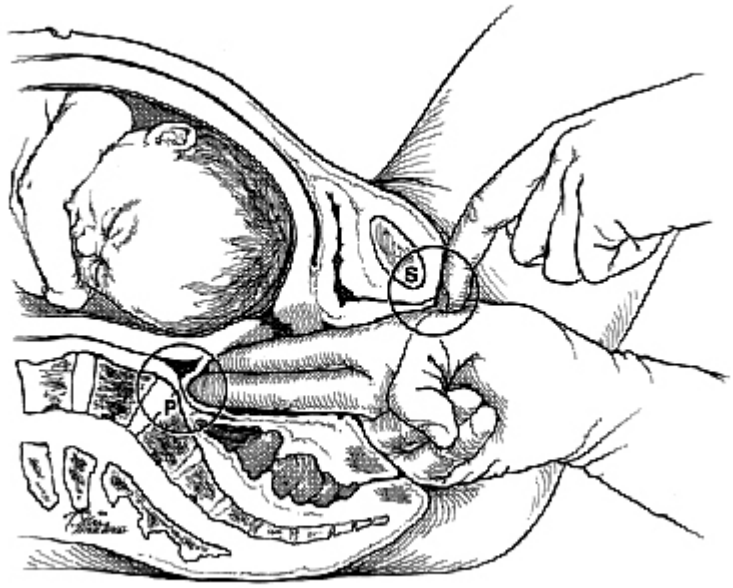
Longitudinal lie, cephalic presentation



Differences in attitude of the fetal body in (A) vertex, (B) brow, and (C) face presentations. A deflexed fetal neck results in a wider presenting cephalic diameter.

Graphic 78180 Version 7.0

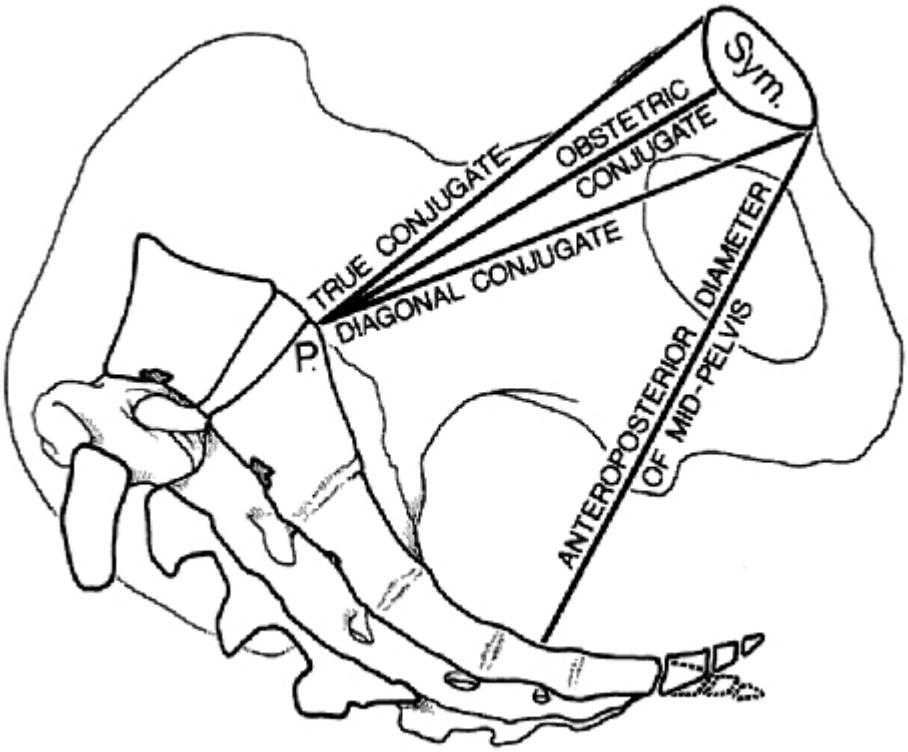
Vaginal examination to determine the diagonal conjugate



P: sacral promontory; S: symphysis pubis.

Graphic 72077 Version 2.0

Pelvic inlet

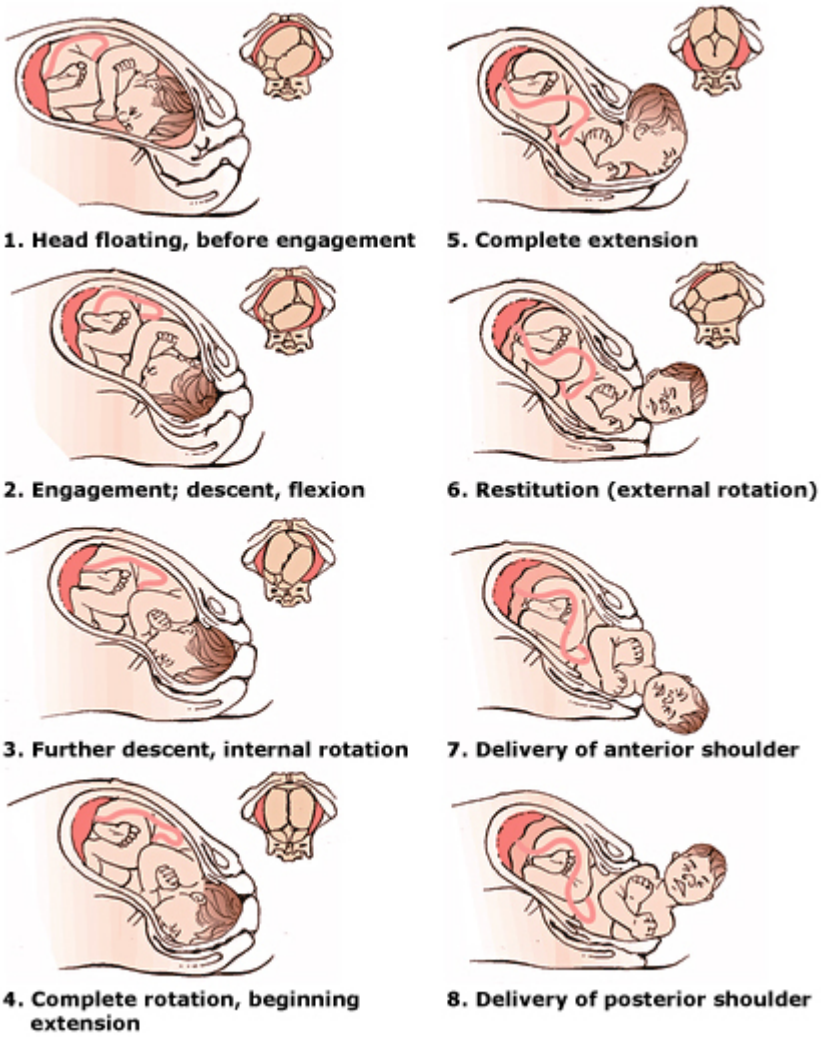


Three anteroposterior diameters of the pelvic inlet are illustrated: the true conjugate, the obstetrically important obstetric conjugate, and the clinically measurable diagonal conjugate. The anteroposterior diameter of the mid-pelvis is also shown.

P: sacral promontory; Sym: symphysis pubis.

Graphic 51127 Version 3.0

Cardinal movements of birth process



The cardinal movements (or mechanisms) of delivery.

Graphic 71178 Version 3.0

Contributor Disclosures

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references to be provided to support the content. Appropriately referenced content is required of all authors and must conform to UpToDate standards of evidence.

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