19

Malpresentations and Malposition

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OUTLINE

KEY ABBREVIATIONS

Amniotic fluid index	AFI
Anteroposterior	AP
Biparietal diameter	BPD
Cerebral palsy	CP
Combined spinal-epidural	CSE
Computed tomography	CT
Confidence interval	CI
External cephalic version	ECV
Fetal heart rate	FHR
Internal podalic version	IPV
Magnetic resonance imaging	MRI
Occipitofrontal diameter	OFD
Occiput posterior	OP
Odds ratio	OR
Perinatal mortality rate	PMR
Periventricular leukomalacia	PVL
Preterm premature rupture of membranes	PPROM
Relative risk	RR
Term Breech Trial	TBT

Near term or during labor, the fetus normally assumes a vertical orientation, or *lie,* and a cephalic presentation, with the flexed fetal vertex presenting to the pelvis (Fig. 19.1). However, in approximately 3% to 5% of singleton gestations at term, an abnormal lie, presentation, or flexed attitude occurs; such deviations constitute fetal malpresentations. **The word *malpresentation* suggests the possibility of adverse consequences, and malpresentation is often associated with increased risk to both the mother and the fetus.** In the early 20th century, malpresentation often led to a variety of maneuvers intended to facilitate vaginal delivery, including destructive operations leading, predictably, to fetal death. Later, manual or instrumented attempts to convert the malpresenting fetus to a more favorable orientation were devised. Internal podalic version (IPV) followed by a complete breech extraction was once advocated as a solution to many malpresentation situations. However, as with most manipulative efforts to achieve vaginal delivery, in many circumstances IPV was associated with high fetal and maternal morbidity and mortality rates and has been largely abandoned.

CLINICAL CIRCUMSTANCES ASSOCIATED WITH MALPRESENTATION

In general, factors associated with malpresentation include (1) diminished vertical capacity of the uterine cavity, (2) increased or decreased fetal mobility, (3) obstructed pelvic inlet, (4) fetal malformation, and (5) prematurity. The association of great parity with malpresentation is presumably related to laxity of maternal abdominal musculature and resultant loss of the normal vertical orientation of the uterine cavity. Placentation low in the pelvis (Fig. 19.2) is another factor that diminishes the likelihood of a fetus assuming a longitudinal axis.[1] Uterine myomata, intrauterine synechiae, and müllerian duct fusion abnormalities such as a septate uterus or uterine didelphys are similarly associated with a higher than expected rate of malpresentation. Because both prematurity and polyhydramnios permit increased fetal mobility, the probability of a noncephalic presentation is greater if preterm labor or rupture of the membranes occurs. Furthermore, preterm birth involves a fetus that is small relative to the maternal pelvis; therefore engagement and descent with labor or rupture of the membranes can occur despite a malpresentation. In contrast, conditions such as chromosomal aneuploidies, congenital myotonic dystrophy, joint contractures from various etiologies, arthrogryposis,

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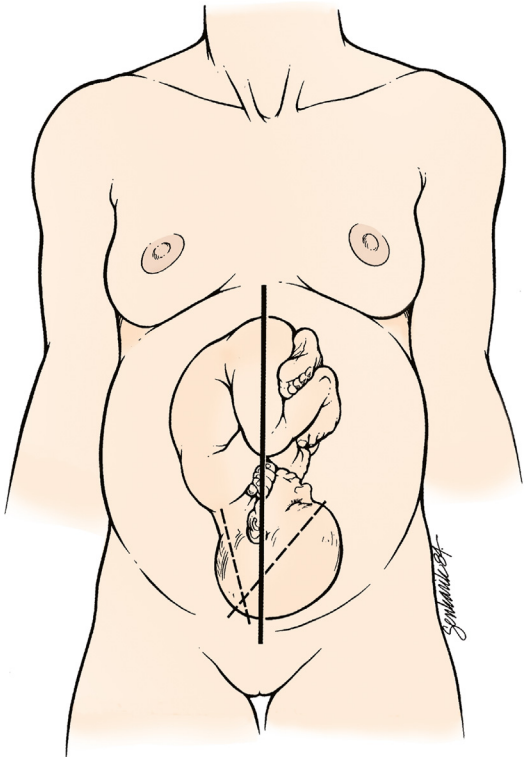

Fig. 19.1 Frontal View of a Fetus in a Longitudinal Lie With Fetal Vertex Flexed on the Neck.

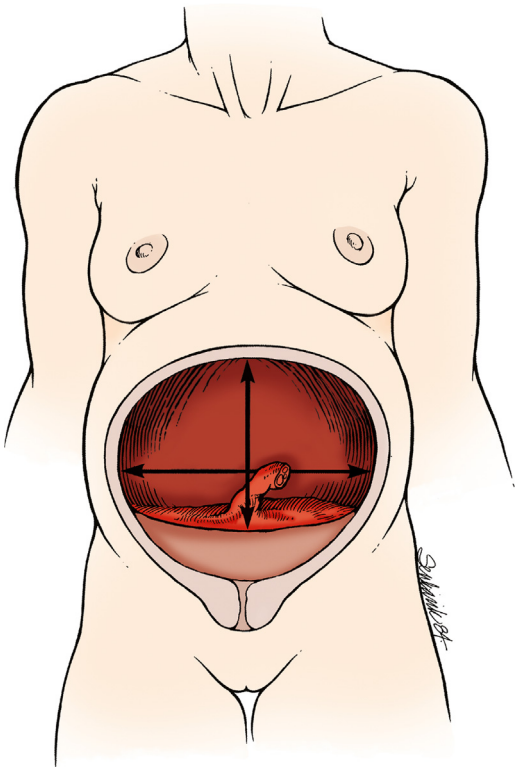

Fig. 19.2 Low Implantation of the Placenta. The placenta would normally be in the vertical orientation of the intrauterine cavity, but its low implantation, illustrated here, increases the probability of a malpresentation.

oligohydramnios, and fetal neurologic dysfunction that result in decreased fetal muscle tone, strength, or activity are also associated with an increased incidence of fetal malpresentation. Finally, the cephalopelvic disproportion associated with severe fetal hydrocephalus or with a contracted maternal pelvis may be implicated as an etiology of malpresentation because normal engagement of the fetal head is prevented.

ABNORMAL AXIAL LIE

The fetal *lie* indicates the orientation of the fetal spine relative to the spine of the mother. The normal fetal lie is longitudinal and by itself does not indicate whether the presentation is cephalic or breech. If the fetal spine or long axis crosses that of the mother, the fetus may be said to occupy a *transverse* or *oblique lie* (Fig. 19.3), which may cause an arm, foot, or shoulder to be the presenting part (Fig. 19.4). The lie may be termed *unstable* if the fetal membranes are intact and fetal mobility is increased, which results in frequent changes of lie and/or presentation.

Abnormal fetal lie is diagnosed in approximately 1 in 300 cases, or 0.33% of pregnancies at term. Prematurity is often a factor, with abnormal lie reported to occur in approximately 2% of pregnancies at 32 weeks' gestation—six times the rate found at term. **Persistence of a transverse, oblique, or unstable lie beyond 37 weeks' gestation requires a systematic clinical assessment and a plan for management; this is because rupture of the membranes without a fetal part filling the inlet of the pelvis poses an increased risk of cord prolapse, fetal compromise, and maternal morbidity if neglected.**

As noted, great parity, prematurity, contraction or deformity of the maternal pelvis, and abnormal placentation are the most commonly reported clinical factors associated with abnormal lie; however, it often happens that none of these factors is present. In fact, any condition

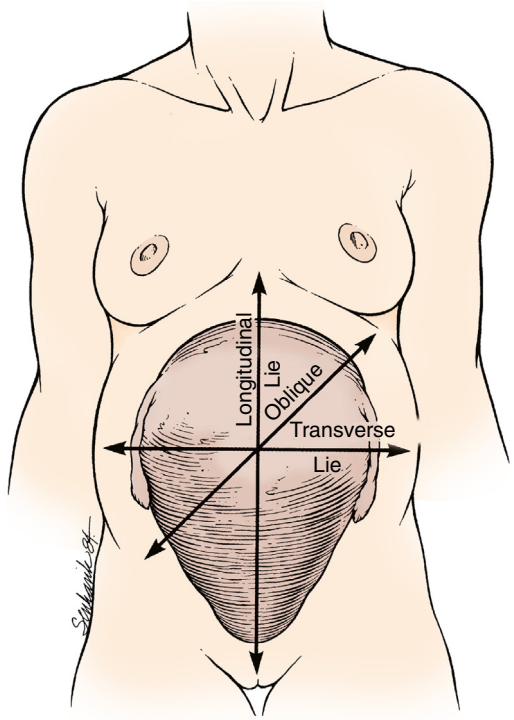

Fig. 19.3 A Fetus May Lie on a Longitudinal, Oblique, or Transverse Axis. The lie does not indicate whether the vertex or the breech fetus is closest to the cervix.

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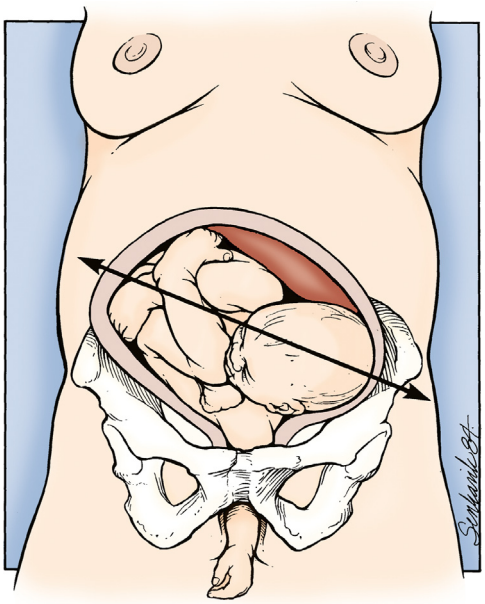

Fig. 19.4 Fetus Lying in an Oblique Axis With an Arm Prolapsing.

that alters the normal vertical capacity of the intrauterine cavity will predispose to abnormal lie.

Diagnosis of the abnormal lie may be made by palpation using Leopold maneuvers or by vaginal examination verified by ultrasound. Although routine use of Leopold maneuvers may be helpful, Thorp and colleagues[2] found the sensitivity of Leopold maneuvers for the detection of malpresentation to be only 28% and the positive predictive value was only 24% compared with immediate ultrasound verification. Others have observed prenatal detection in as few as 41% of cases before labor. Adaptations have been made to the Leopold maneuvers that may improve detection of an abnormal lie or presentation. The Sharma modified Leopold maneuver and the Sharma right and left lateral maneuvers in the original report[3] demonstrated improved diagnostic accuracy; they detected vertex presenting occipitoanterior (95% vs. 84.4%, $P = .04$), posterior presentations (96.3% vs. 66.6%, $P = .00012$), and breech presentations correctly more often than with traditional Leopold maneuvers. These maneuvers use the forearms in addition to the hands and fingers. As with any abdominal palpation technique, limitations on accuracy are to be expected in the obese patient and in a patient with uterine myomata. **The ready availability of ultrasound in most clinical settings is of benefit, and its use can obviate the vagaries of the abdominal palpation techniques. In all situations, early diagnosis of malpresentation is of benefit.** A reported fetal loss rate of 9.2% with an early diagnosis versus a loss rate of 27.5% with a delayed diagnosis indicates that early diagnosis improves fetal outcome.

Reported perinatal mortality rates (PMRs) for unstable or transverse lie (corrected for lethal malformations and extreme prematurity) vary from 3.9% to 24%, with maternal mortality as high as 10%. Maternal deaths are usually related to infection after premature rupture of membranes, hemorrhage secondary to abnormal placentation, complications of operative intervention for cephalopelvic disproportion, or traumatic delivery. Fetal loss of phenotypically and chromosomally normal gestations at ages considered to be viable is primarily associated with delayed interventions, prolapsed cord, or traumatic delivery. **Cord prolapse occurs 20 times as often with abnormal lie as it does with a cephalic presentation.**

MANAGEMENT OF A SINGLETON GESTATION

Safe vaginal delivery of a fetus from an abnormal axial lie is not generally possible. A search for the etiology of the malpresentation is always indicated. A transverse/oblique or unstable lie late in the third trimester necessitates ultrasound examination to exclude a major fetal malformation and abnormal placentation. Fortunately, most cases of major fetal anomalies or abnormal placentation can currently be diagnosed long before the third trimester. Phelan and colleagues[4] reported 29 patients with transverse lie diagnosed at or beyond 37 weeks' gestation and managed expectantly, and 83% (24 of 29) spontaneously converted to breech (9 of 24) or vertex (15 of 24) before labor; however, the overall cesarean delivery rate was 45%, with two cases of cord prolapse, one uterine rupture, and one neonatal death. Hankins and colleagues[5] compared the outcomes of 14 mother-infant pairs found to be in a transverse lie at 37 weeks to 28 breech and 28 vertex controls matched for gestational age, route of delivery, and the presence of labor. Newborn outcomes for those with a transverse lie were significantly worse, including more with severe acidosis (3 of 14 vs. 1 of 56, $P = .04$) and more with significant birth trauma (5 of 14 vs. 1 of 28 breech, $P = .01$ and 2 of 28 vertex, $P = .03$). **External cephalic version (ECV) is recommended at 36 to 37 weeks to help diminish the risk of adverse outcome, and failing this, cesarean is recommended at 38 weeks.**[5] There is no place for IPV and breech extraction in contemporary management of transverse or oblique lie or in an unstable presentation in a potentially viable singleton pregnancy because of the unacceptably high rate of fetal and maternal complications.

A persistent abnormal axial lie, particularly if accompanied by ruptured membranes, also alters the choice of uterine incision at cesarean delivery. **A low transverse (Kerr) uterine incision has many surgical advantages and is generally the preferred approach for cesarean delivery for an abnormal lie** (see Chapter 21). Because up to 25% of transverse incisions may require vertical extension for delivery of an infant from an abnormal lie, and because the lower uterine segment is often poorly developed and insufficiently broad such that atraumatic delivery of the presenting part is made more difficult, other uterine incisions may be considered. A "J" or "T" extension of the low transverse incision results in a uterine scar that is more susceptible to subsequent rupture due to poor vascularization. **Therefore in the uncommon case of a transverse or oblique lie with a poorly developed lower uterine segment, when a transverse incision is deemed unfeasible or inadequate, a vertical incision (low vertical or classical) may be a reasonable alternative. A vertical uterine incision is also preferred to facilitate extraction of the fetus in the setting of a "back down" transverse lie as determined by preoperative ultrasound.** Intraoperative cephalic version may allow the use of a low transverse incision, but ruptured membranes or oligohydramnios may make this difficult. Uterine relaxing agents such as inhalational anesthetics or intravenous nitroglycerin may improve success of these maneuvers if the difficulty is attributable to a contracted uterine fundus.

DEFLECTION ATTITUDES

Attitude **refers to the position of the fetal head in relation to the neck. The normal attitude of the fetal head during labor is one of full flexion with the fetal chin against the upper chest.** Deflexed attitudes include various degrees of deflection or even extension of the fetal neck and head (Fig. 19.5), leading to, for example, face or brow presentations. Spontaneous conversion to a more normal, flexed attitude or further extension of an intermediate deflection to a fully

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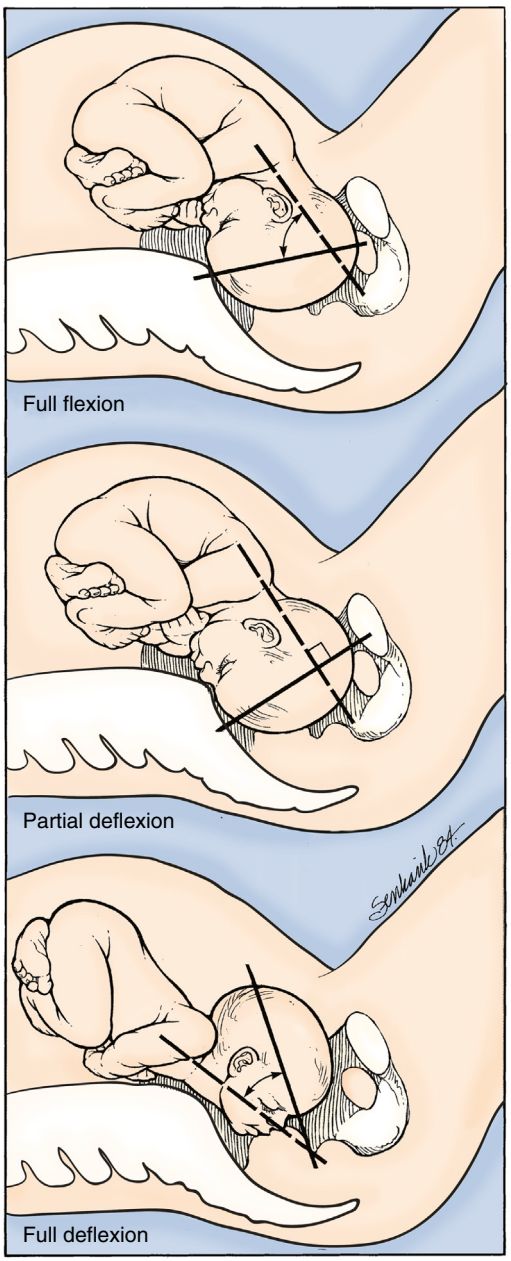

Fig. 19.5 Normal "Attitude." *Top,* Full flexion shows fetal vertex flexed on the neck. Partial deflexion *(middle)* shows the fetal vertex intermediate between flexion and extension. Full deflexion *(lower)* shows the fetal vertex completely extended with the face presenting.

extended position commonly occurs as labor progresses, owing to resistance exerted by the bony pelvis and soft tissues. **Although safe vaginal delivery is possible in many cases, experience indicates that cesarean delivery may be the most appropriate alternative when arrest of progress is observed.**

FACE PRESENTATION

A face presentation is characterized by a longitudinal lie and full extension of the fetal neck and head with the occiput against the upper back (Fig. 19.6). **The fetal chin (mentum) is chosen as the point of designation during vaginal examination.** For example, a fetus presenting by the face and whose chin is in the right posterior quadrant of the maternal pelvis would be called a *right mentum posterior* (Fig. 19.7). The reported incidence of face presentation ranges from 0.14% to 0.54% and averages approximately 0.2%, or 1 in 500 live births overall.[6,7] The reported PMR, corrected for nonviable malformations and extreme prematurity, varies from 0.6% to 5% and averages approximately 2% to 3%.

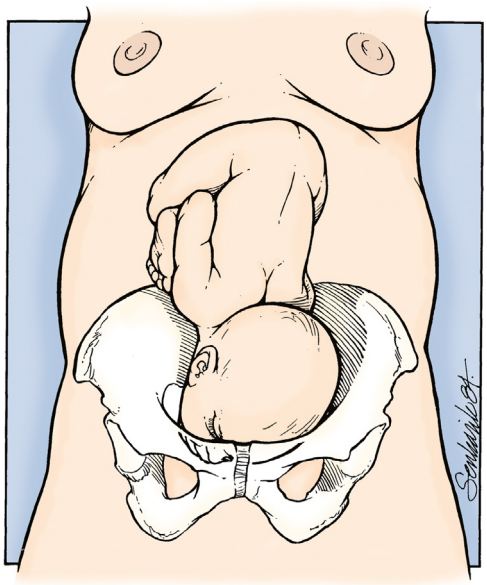

Fig. 19.6 This Fetus With the Vertex Completely Extended on the Neck Enters the Maternal Pelvis in a Face Presentation. The cephalic prominence would be palpable on the same side of the maternal abdomen as the fetal spine.

All clinical factors known to increase the general rate of malpresentation have been implicated in face presentation; many infants with a face presentation have malformations. Anencephaly, for instance, is found in approximately one-third of cases of face presentation. Fetal goiter and tumors of the soft tissues of the head and neck may also cause deflexion of the head. Frequently observed maternal factors include a contracted pelvis or cephalopelvic disproportion in 10% to 40% of cases. In a review of face presentation, Duff[7] found that one of these etiologic factors was found in up to 90% of cases.

Early recognition of the face presentation is important, and the diagnosis can be suspected when abdominal palpation finds the fetal cephalic prominence on the same side of the maternal abdomen as the fetal back (Fig. 19.8); however, **face presentation is more often discovered by vaginal examination.** In practice, fewer than 1 in 20 infants with face presentation is diagnosed by abdominal examination. In fact, only half of these infants are found by any means to have a face presentation before the second stage of labor, and half of the remaining cases are undiagnosed until delivery. However, perinatal mortality may be higher with late diagnosis.

Mechanism of Labor

Knowledge of the early mechanism of labor for face presentation is incomplete. Many infants with a face presentation probably begin labor in the less extended brow position. With descent into the pelvis, the forces of labor press the fetus against maternal tissues; subsequent flexion (to a vertex presentation) or full extension of the head on the

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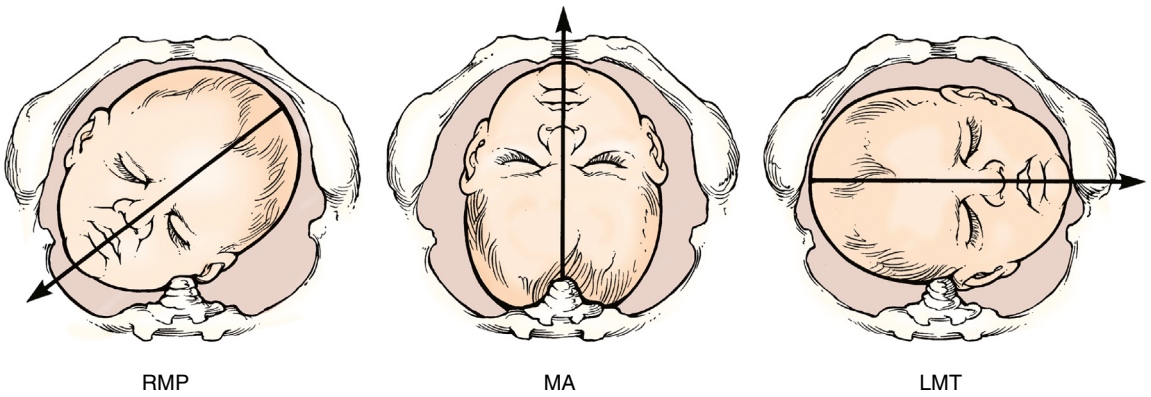

Fig. 19.7 The Point of Designation From Digital Examination in the Case of a Face Presentation Is the Fetal Chin Relative to the Maternal Pelvis. *Left,* Right mentum posterior *(RMP)*; *middle,* mentum anterior *(MA)*; *right,* left mentum transverse *(LMT)*.

Fig. 19.8 Palpation of the maternal abdomen in the case of a face presentation should find the fetal cephalic prominence on the side *away* from the fetal small parts, instead of on the same side, as in the case of a normally flexed fetal neck and head.

spine (to a face presentation) then occurs. **The labor of a face presentation must include engagement, descent, internal rotation generally to a mentum anterior position, and delivery by flexion as the chin passes under the symphysis** (Fig. 19.9). However, flexion of the occiput may not always occur, and delivery in the fully extended attitude may be common.

The prognosis for labor with a face presentation depends on the orientation of the fetal chin. At diagnosis, 60% to 80% of infants with a face presentation are mentum anterior,[7] 10% to 12% are mentum transverse,[8] and 20% to 25% are mentum posterior.[8] Almost all average-sized infants presenting mentum anterior with adequate maternal pelvic dimensions will achieve spontaneous or assisted vaginal delivery. Furthermore, most mentum transverse infants will rotate to the mentum anterior position and will deliver vaginally, and even 25% to 33% of mentum posterior infants will rotate and deliver vaginally in the mentum anterior position. In a review of 51 cases of persistent face presentation, Schwartz and colleagues[8] found that the mean birthweight of those infants in a mentum posterior position who did rotate and deliver vaginally was 3425 g, compared with 3792 g for those infants who did not rotate and deliver vaginally. **However, persistence of the mentum posterior position with an infant of normal size makes safe vaginal delivery less likely. Overall, 70% to 80% of infants with a face presenting can be delivered vaginally, either spontaneously or by low forceps in the hands of a skilled operator, whereas 12% to 30% require cesarean delivery.** Manual attempts to convert the face to a flexed attitude or to rotate a posterior position to a more favorable mentum anterior position are rarely successful and increase both maternal and fetal risks.[6]

Prolonged labor is a common feature of face presentation and has been associated with an increased number of intrapartum deaths; therefore prompt attention to an arrested labor pattern is recommended. In the case of an average or small fetus, an adequate pelvis, and hypotonic labor, oxytocin may be considered. No absolute contraindication to oxytocin augmentation of hypotonic labor in face

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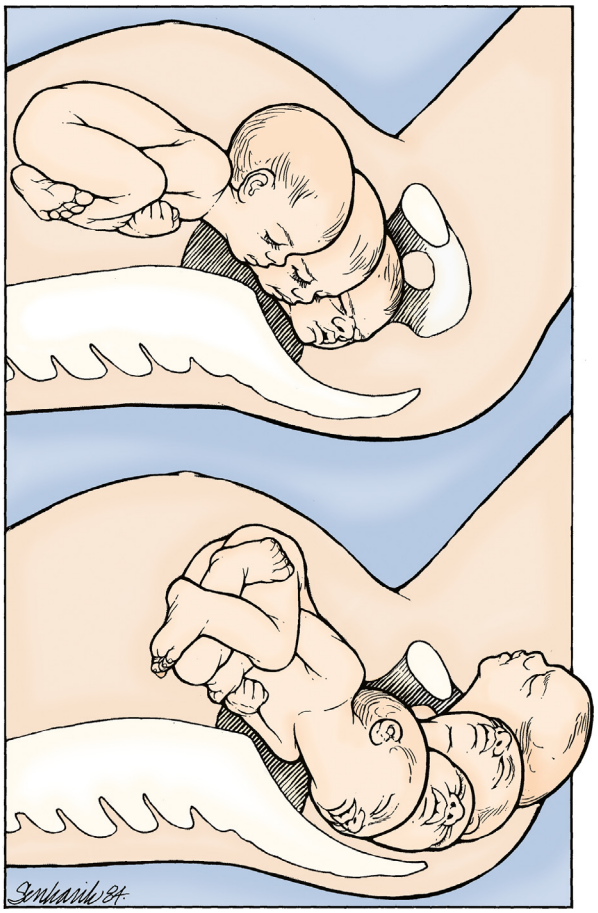

Fig. 19.9 Engagement, descent, and internal rotation remain cardinal elements of vaginal delivery in the case of a face presentation, but successful vaginal delivery of a term-size fetus presenting a face generally requires delivery by flexion under the symphysis from a mentum anterior position, as illustrated here.

presentations exists, but an arrest of progress despite adequate labor should call for cesarean delivery.

Worsening of the fetal condition in labor is common. Several observers have found that abnormal fetal heart rate (FHR) patterns occur more often with face presentation.[6,7] Continuous intrapartum electronic FHR monitoring of a fetus with face presentation is considered mandatory, but extreme care must be exercised in the placement of an electrode because ocular or cosmetic damage is possible. **If external Doppler heart rate monitoring is inadequate and an internal electrode is recommended, placement of the electrode on the fetal chin is often preferred.**

Contraindications to vaginal delivery of a face presentation include macrosomia, nonreassuring FHR monitoring even without arrested or protracted labor, or an inadequate maternal pelvis; cesarean delivery has been reported in as many as 60% of cases of face presentation for these reasons.[7] If cesarean delivery is warranted, care should be taken to flex the head gently, both to accomplish elevation of the head through the hysterotomy incision as well as to avoid potential cervical nerve damage to the neonate. Forced flexion may also result in fetal injury, especially with fetal goiter or neck tumors.

Fetal laryngeal and tracheal edema that results from the pressure of the birth process might require immediate nasotracheal intubation.

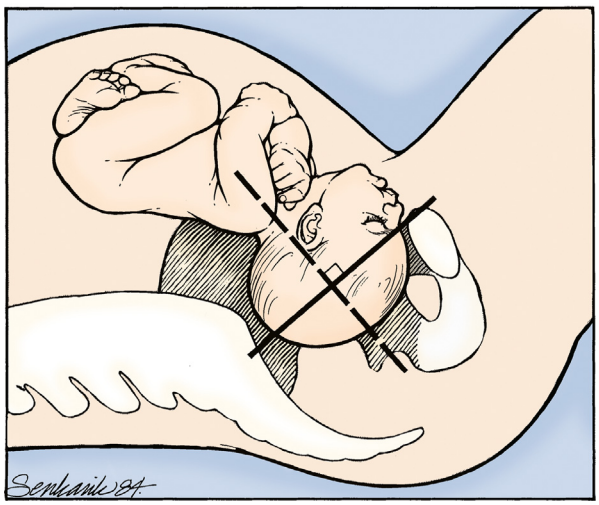

Fig. 19.10 This Fetus Is in a Brow Presentation in a Frontum Anterior Position. The head is in an intermediate deflexion attitude.

Nuchal tumors or simple goiters, fetal anomalies that might have caused the malpresentation, require expert neonatal management, including the possibility of an ex utero intrapartum treatment procedure, which establishes a fetal/neonatal airway before the umbilical cord is clamped. Identification of and planning for these particular circumstances in the prelabor setting are ideal.[9]

BROW PRESENTATION

A fetus in a brow presentation occupies a longitudinal axis with a partially deflexed cephalic attitude midway between full flexion and full extension (Fig. 19.10). **The frontal bones are the point of designation.** If the anterior fontanel is on the mother's left side, with the sagittal suture in the transverse pelvic axis, the fetus would be in a left frontum transverse position (Fig. 19.11). The reported incidence of brow presentation varies widely, from 1 in 670 to 1 in 3433, **averaging approximately 1 in 1500 deliveries.** Brow presentation is detected more often in early labor before flexion to a normal attitude occurs. Less frequently, further extension results in a face presentation.

In 1976, the PMR corrected for lethal anomalies and very low birthweight varied from 1% to 8%.[10] In a study of 88,988 deliveries, corrected PMRs for brow presentations depended on the mode of delivery; a loss rate of 16%, the highest in this study, was associated with manipulative vaginal birth. More contemporary studies without manipulative vaginal birth report much lower PMRs, between 0.5 and 1.2%.[11] **Therefore manual attempts to correct a face or brow presentation by flexing the fetal head during labor are contraindicated.**

In general, factors that delay engagement are associated with persistent brow presentation. Cephalopelvic disproportion, prematurity, polyhydramnios, and high parity are often found and have been implicated in more than 60% of cases of persistent brow presentation. Detection of a brow presentation by abdominal palpation is unusual in practice. More often, a brow presentation is detected on vaginal examination. As in the case of a face presentation, diagnosis in labor is more likely. **Fewer than 50% of brow presentations are detected before the second stage of labor, and most of the remainder are undiagnosed until delivery.** Frontum anterior is reportedly the most common position at diagnosis, occurring about twice as often as either transverse or posterior positions. Although the initial position at diagnosis may be of limited prognostic value, the cesarean delivery rate

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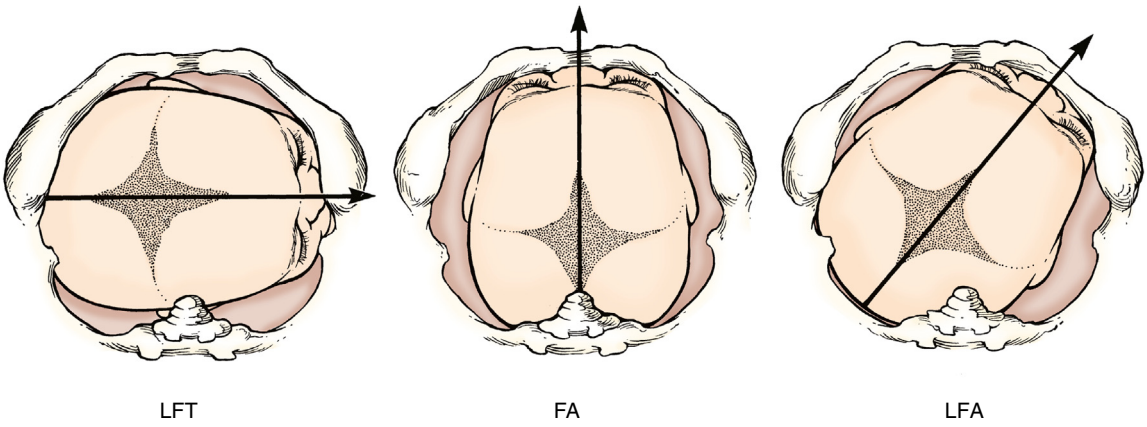

Fig. 19.11 In Brow Presentation, the Anterior Fontanel *(Frontum)* Relative to the Maternal Pelvis Is the Point of Designation. *Left,* Left frontum transverse *(LFT)*; *middle,* frontum anterior *(FA)*; *right,* left frontum anterior *(LFA)*.

is higher with frontum transverse or frontum posterior than with frontum anterior positioning.

A persistent brow presentation requires engagement and descent of the largest (occipitomental) diameter of the fetal head. This process is possible only with a large pelvis or a small infant, or both. However, most brow presentations convert spontaneously by flexion or further extension to either a vertex or a face presentation and are then managed accordingly. The earlier the diagnosis is made, the more likely conversion will occur spontaneously. Fewer than half of fetuses with persistent brow presentations undergo spontaneous vaginal delivery, but in most cases, a trial of labor is not contraindicated.[10]

Prolonged labors have been observed in 33% to 50% of brow presentations, and secondary arrest is not uncommon. Forced conversion of the brow to a more favorable position with forceps is contraindicated, as are attempts at manual conversion. One unexpected cause of persistent brow presentation may be an open fetal mouth pressed against the vaginal wall, splinting the head and preventing either flexion or extension (Fig. 19.12). Although this is rare in phenotypically normal fetuses, it needs to be considered in anomalous conditions of the fetus, such as epignathus, a rare oropharyngeal teratoma.

Similar to face presentations, minimal manipulation yields the best results if the FHR pattern remains reassuring. Expectant management may be justified, preferably with a relatively large pelvis in relation to fetal size and adequate labor progress, according to one large study.[12] If a brow presentation persists with a large baby, successful vaginal delivery is unlikely, and cesarean delivery may be most prudent.

Radiographic or computed tomography (CT) pelvimetry is not used clinically, and one report states that although 91% of cases with adequate pelvimetry converted to a vertex or a face presentation and delivered vaginally, 20% with some form of pelvic contracture did also. **Therefore, regardless of pelvic dimensions, consideration of a trial of labor with careful monitoring of maternal and fetal condition may be appropriate.** As in the case of a face presentation, oxytocin may be used cautiously to correct hypotonic contractions, but prompt resumption of progress toward delivery should follow.

COMPOUND PRESENTATION

Whenever an extremity, most commonly an upper extremity, is found prolapsed beside the main presenting fetal part, the situation is referred to as a *compound presentation* (Fig. 19.13). **The reported incidence ranges from 1 in 250 to 1 in 1500 deliveries.**[13-15] **The combination of an upper extremity and the vertex is the most common.**

This diagnosis should be suspected with any arrest of labor in the active phase or failure to engage, especially after rupture of the membranes or when the fetal head is deviated from the midline.[16] Diagnosis is made on vaginal examination by discovery of an irregular mobile tissue mass adjacent to the larger presenting part. Recognition late in labor is common, and as many as 50% of persisting compound presentations are not detected until the second stage. Delay in diagnosis may not be detrimental because it is likely that only the persistent cases require intervention.

Although maternal age, race, parity, and pelvic size have been associated with compound presentation, prematurity is the most consistent clinical finding. The very small premature fetus is at great risk of persistent compound presentation. In late pregnancy, ECV of a fetus in breech position increases the risk of a compound presentation.

Older studies reported high PMRs with compound presentations, but these were most likely due to delayed diagnoses in an era without ultrasound or with the use of procedures such as IPV and breech extraction, which are no longer practiced. In the modern era, with ready availability of bedside ultrasound and liberal use of cesarean delivery for protraction or arrest disorders, modern reports of fetal risk are limited to cord prolapse or injury to the prolapsed fetal extremity.[17,18] **Cord prolapse occurs in 11% to 20% of cases, and it is the most frequent complication of this malpresentation.** Cord prolapse probably occurs because the compound extremity splints the larger presenting part and results in an irregular fetal aggregate that incompletely fills the pelvic inlet. Maternal risks include soft tissue damage and obstetric laceration.[19]

Again, although laboring is not proscribed, **the prolapsed extremity should not be manipulated. However, it may spontaneously retract as the major presenting part descends.** Seventy-five percent of vertex/upper extremity combinations deliver spontaneously. Occult or obscured cord prolapse is possible; therefore continuous electronic FHR monitoring is recommended. The primary indications for surgical intervention (i.e., cesarean delivery) are cord prolapse, nonreassuring FHR patterns, and arrest of labor. **Cesarean delivery is the only appropriate clinical intervention for cord prolapse and nonreassuring FHR patterns because both version extraction and**

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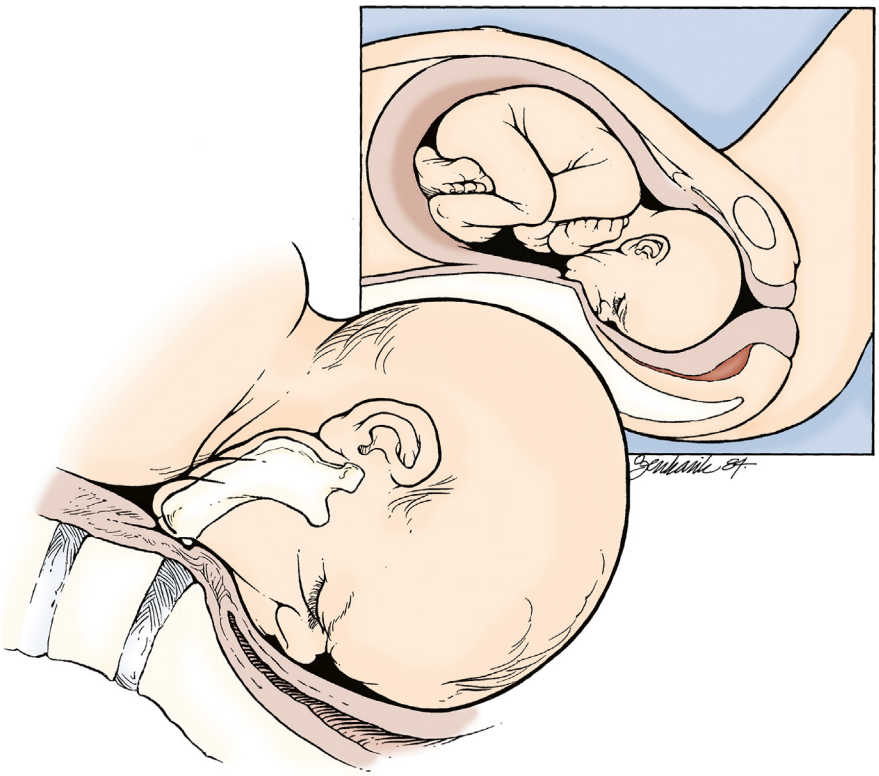

Fig. 19.12 The Open Fetal Mouth Against the Vaginal Sidewall May Brace the Head in the Intermediate Deflexion Attitude.

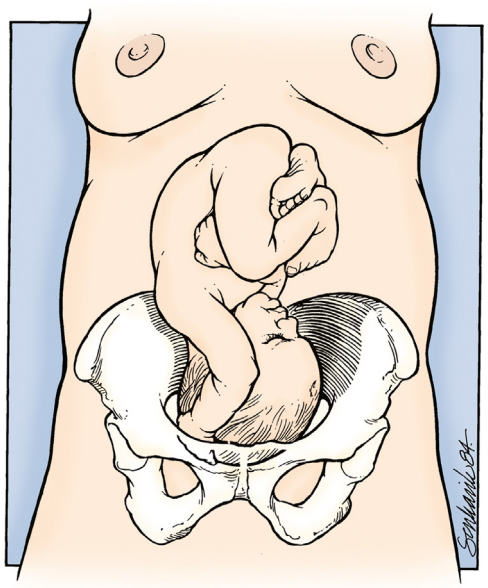

Fig. 19.13 The compound presentation of an upper extremity and the vertex illustrated here most often spontaneously resolves with further labor and descent.

repositioning the prolapsed extremity are associated with adverse outcome and should be avoided. From 2% to 25% of compound presentations require cesarean delivery. Protraction of the second stage of labor and dysfunctional labor patterns have been noted to occur more frequently with persistent compound presentations. As in other malpresentations, spontaneous resolution occurs more often, and surgical intervention is less frequently necessary in those cases diagnosed early in labor. Small or premature fetuses are more likely to have persistent compound presentations but are also more likely to have a successful vaginal delivery. **Persistent compound presentation with parts other than the vertex and hand in combination in a term-sized infant has a poor prognosis for safe vaginal delivery, and cesarean delivery is usually necessary.** However, a simple compound presentation (e.g., hand) may be allowed to labor, if labor is progressing normally with reassuring fetal status.

BREECH PRESENTATION

The infant presenting as a breech occupies a longitudinal axis with the cephalic pole in the uterine fundus. This presentation occurs in 3% to 4% of labors overall, although it is found in 7% of pregnancies at 32 weeks and in 25% of pregnancies of less than 28 weeks' duration.[20] The three types of breech are noted in Table 19.1. The infant in the *frank breech* position is flexed at the hips with extended knees (pike position). The *complete breech* is flexed at both joints (tuck position), and the *footling* or *incomplete breech* has one or both hips partially or fully extended (Fig. 19.14).

The diagnosis of breech presentation may be made by abdominal palpation or vaginal examination and confirmed by ultrasound. **Prematurity, fetal malformation, müllerian anomalies, and polar placentation are commonly observed causative factors.** High rates of breech presentation are noted in certain fetal genetic disorders, including trisomies 13, 18, and 21; Potter syndrome; and myotonic

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dystrophy. Conditions that alter fetal muscular tone and mobility (e.g., increased and decreased amniotic fluid) also increase the frequency of breech presentation. The breech head appears dolichocephalic on ultrasound, and for that reason, the biparietal diameter (BPD) appears small. However, the head circumference remains unaffected. This difference may be as much as 16+ days (95% confidence interval [CI], 14.3 to 18.1; $P = .001$).[21] Although the contracted BPD may affect ultrasound-determined weight estimates of the fetus, an occipitofrontal diameter (OFD)—to-BPD ratio of greater than 1.3 in the absence of other indicators of growth delay signals the deformation characteristic of the breech-presenting fetus. Approximately 80% of breech fetuses will have a dolichocephalic contour, previously termed the "breech head."[22] The fundus of the uterus assumes a more elongated contour than the bowl-like developed lower uterine segment. Thus it is believed that forces external to the fetus are responsible for this head shape. Because both dolichocephaly and breech *may* be associated with a genetically and phenotypically anomalous fetus, it behooves the sonologist to perform a detailed survey of the fetal anatomy prior to assuming the presence of the "breech head."

TABLE 19.1 Breech Categories

Type	Overall % of Breeches	Risk of Cord Prolapse (%)	Premature (%)
Frank	48—73[a–c]	0.5	38
Complete	4.6—11.5[b,c]	4—6	12
Footling	12—38[c]	15—18	50

[a]Data from Collea JV, Chein C, Quilligan EJ. The randomized management of term frank breech presentation: a study of 208 cases. *Am J Obstet Gynecol.* 1980;137:235-244.
[b]Data from Gimovsky ML, Wallace RL, Schifrin BS et al. Randomized management of the nonfrank breech presentation at term: a preliminary report. *Am J Obstet Gynecol.*1983;146:34-40.
[c]Data from Brown L, Karrison T, Cibils LA. Mode of delivery and perinatal results in breech presentation. *Am J Obstet Gynecol.* 1994;171:28-34.

Mechanism and Conduct of Labor and Vaginal Delivery

The two most important elements for the safe conduct of vaginal breech delivery are continuous electronic FHR monitoring and noninterference until spontaneous delivery of the breech fetus to the umbilicus has occurred. Early in labor, the capability for immediate cesarean delivery should be established. Anesthesia should be available, the operating room readied, and appropriate informed consent obtained (discussed later). Two obstetricians should be in attendance in addition to a pediatric team. Appropriate training and experience with vaginal breech delivery are fundamental to success. Because experience is becoming less common, simulation of breech deliveries will help to maintain these skills. The instrument table should be prepared in the customary manner, with the addition of Piper forceps and extra towels. No contraindication exists to epidural analgesia in labor, and many believe epidural anesthesia to be an asset in the control and conduct of the second stage.

The infant presenting in the frank breech position usually enters the pelvic inlet in one of the diagonal pelvic diameters (Fig. 19.15). **Engagement has occurred when the bitrochanteric diameter of the fetus has progressed beyond the plane of the pelvic inlet, although by vaginal examination, the presenting part may be palpated only at a station of −2 to −4 (out of 5).** As the breech fetus descends and encounters the levator ani muscular sling, internal rotation usually occurs to bring the bitrochanteric diameter into the anteroposterior (AP) axis of the pelvis. **The point of designation in a breech labor is the fetal sacrum;** therefore when the bitrochanteric diameter is in the AP axis of the pelvis, the fetal sacrum will lie in the transverse pelvic diameter (Fig. 19.16).

If normal descent occurs, the breech fetus will present at the outlet and will begin to emerge, first as sacrum transverse, then rotating to sacrum anterior. This direction of rotation may reflect the greater capacity of the hollow of the posterior pelvis to accept the fetal chest

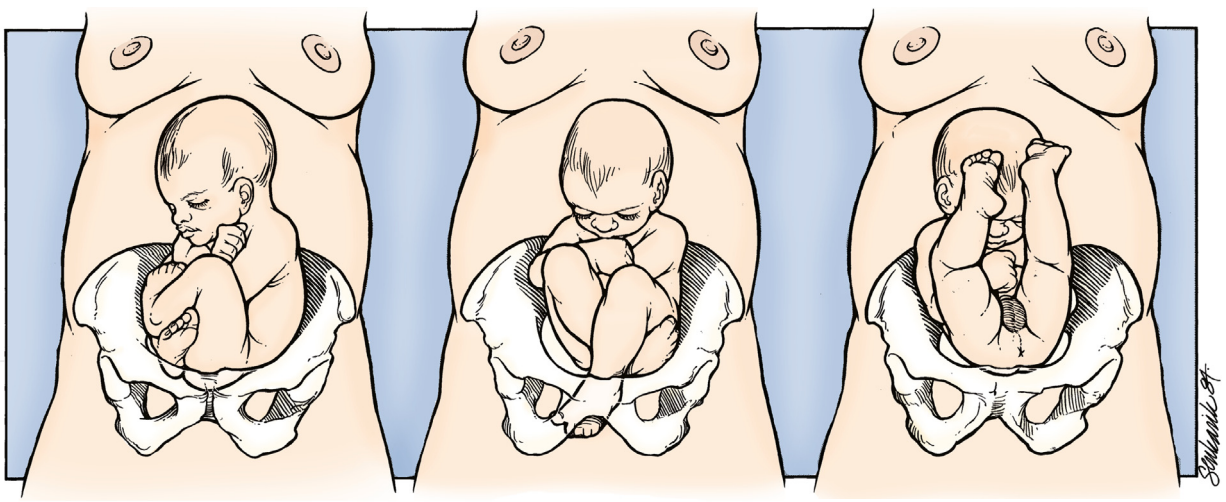

Fig. 19.14 Three Types of Breech Presentation. The *complete breech* is flexed at the hips and flexed at the knees. The *footling or incomplete breech* shows incomplete deflexion of one or both knees or hips. The *frank breech* is flexed at the hips and extended at the knees.

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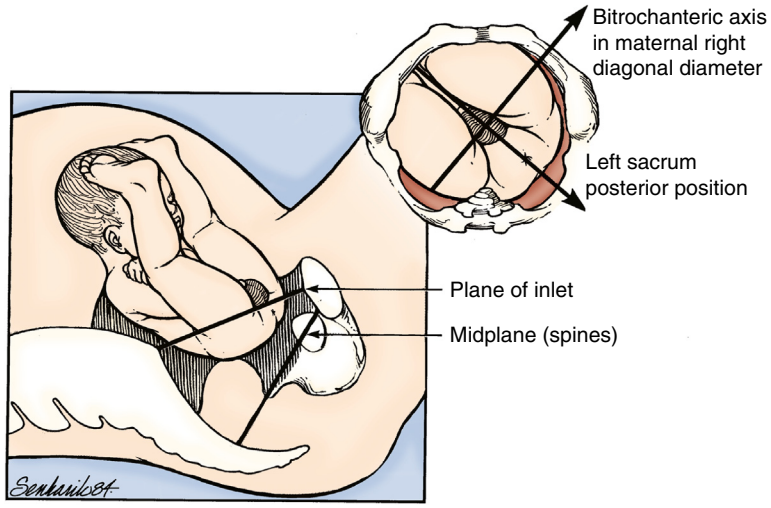

Fig. 19.15 Breech Presentation With Left Sacrum Posterior Alignment. The breech fetus typically enters the inlet with the bitrochanteric diameter aligned with one of the diagonal diameters, with the sacrum as the point of designation in the other diagonal diameter.

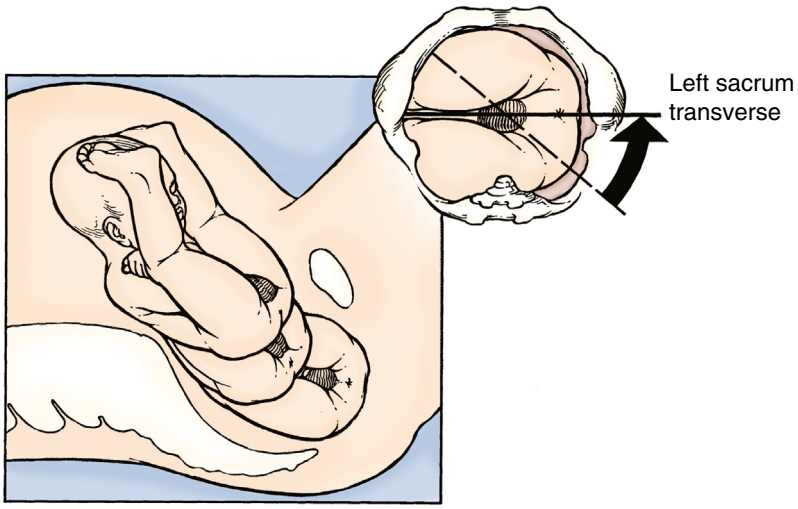

Fig. 19.16 With labor and descent, the bitrochanteric diameter generally rotates toward the anteroposterior axis, and the sacrum rotates toward the transverse axis.

and small parts. Crowning occurs when the bitrochanteric diameter passes under the pubic symphysis. **It is important to emphasize that operator intervention is not yet needed or helpful, other than possibly to perform the episiotomy if indicated and to encourage maternal expulsive efforts.**

Premature or aggressive intervention may adversely affect the delivery in at least two ways. First, complete cervical dilation must be sustained for sufficient duration to retard retraction of the cervix and entrapment of the aftercoming fetal head. Rushing the delivery of the trunk may result in cervical retraction. Second, the safe descent and delivery of the breech infant must be the result of uterine and maternal expulsive forces only to maintain neck flexion. Any traction by the provider in an effort to speed delivery would encourage deflexion of the neck and result in the presentation of the larger occipitofrontal fetal cranial profile to the pelvic inlet (Fig. 19.17). **Such an event could be catastrophic. Rushed delivery also increases the risk of a nuchal arm, with one or both arms trapped behind the head above the pelvic inlet.** Entrapment of a nuchal arm makes safe vaginal delivery much more difficult because it dramatically increases the aggregate size of delivering fetal parts that must egress vaginally. Therefore safe breech delivery of an average-sized infant depends predominantly on maternal expulsive forces and patience, *not* traction, from the provider.

As the frank breech emerges further, the fetal thighs are typically flexed firmly against the fetal abdomen, often splinting and protecting the umbilicus and cord. **The Pinard maneuver may be needed to facilitate delivery of the legs in a frank breech presentation. After delivery to the umbilicus has occurred, pressure is applied to the medial aspect of the knee, which causes flexion and subsequent delivery of the lower leg.** Simultaneous to this, the fetal pelvis is rotated away from that side (Fig. 19.18). This results in external rotation of the thigh at the hip, flexion of the knee, and delivery of one leg at a time. The dual movement of counterclockwise rotation of the fetal pelvis as the operator externally rotates the fetal right thigh and

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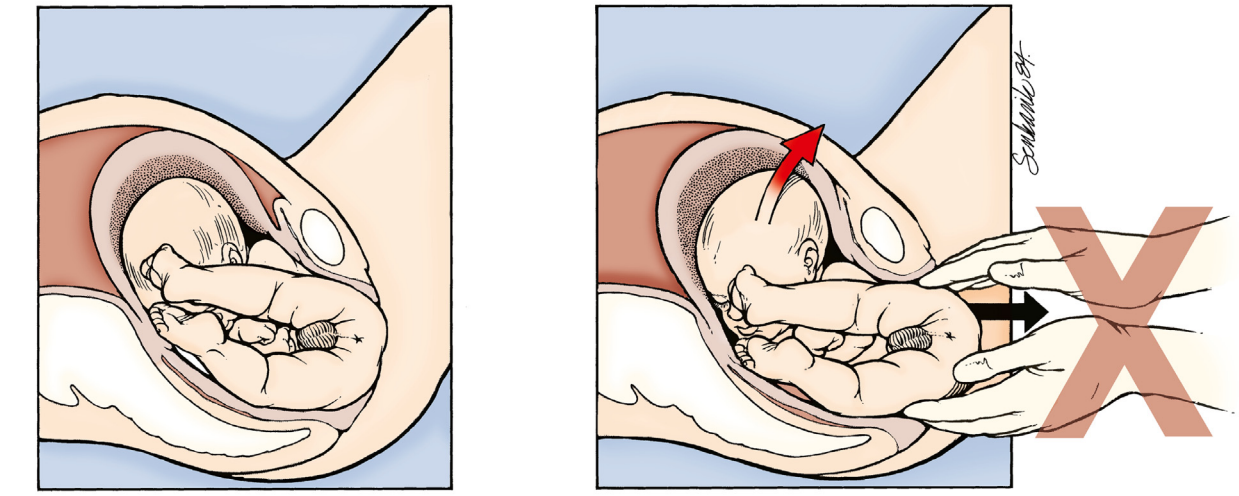

Fig. 19.17 (A) The fetus emerges spontaneously, whereas uterine contractions maintain cephalic flexion. (B) Premature aggressive traction encourages deflexion of the fetal vertex and increases the risk of head entrapment or nuchal arm entrapment.

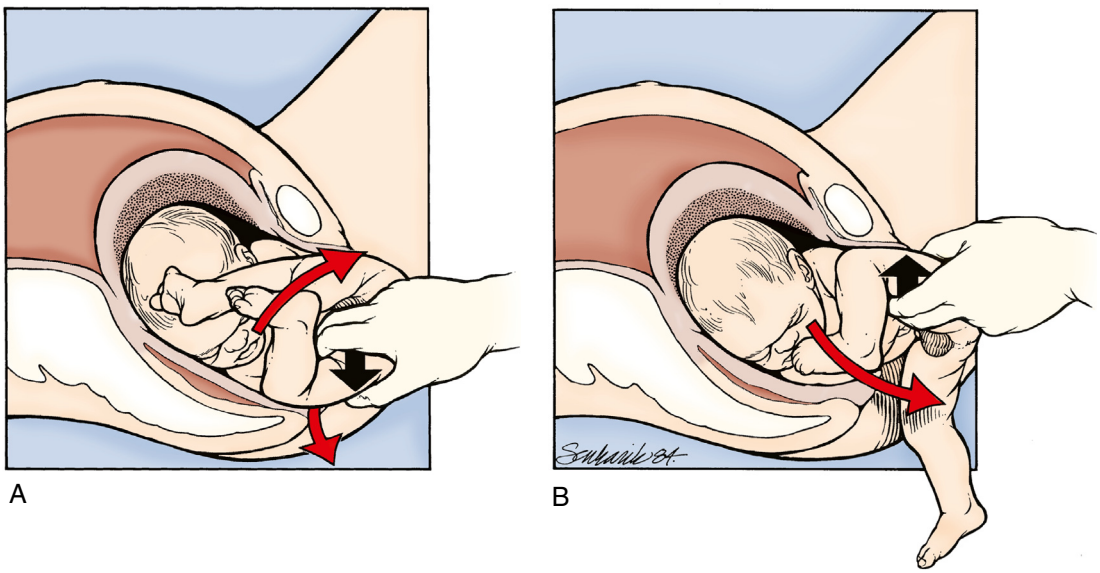

Fig. 19.18 After spontaneous expulsion to the umbilicus, external rotation of each thigh (A) combined with opposite rotation of the fetal pelvis results in flexion of the knee and delivery of each leg (B).

clockwise rotation of the fetal pelvis as the operator externally rotates the fetal left thigh is most effective in facilitating delivery. The fetal trunk is then wrapped with a towel to provide secure support of the body while further descent results from expulsive forces from the mother. The operator primarily facilitates the delivery of the fetus by providing support and guiding the body through the introitus. The operator is not applying outward traction on the fetus, which might result in deflexion of the fetal head or nuchal arm.

When the scapulae appear at the introitus, the operator may slip a hand over the fetal shoulder from the back (Fig. 19.19); follow the humerus; and, with movement from medial to lateral, sweep first one and then the other arm across the chest and out over the perineum. Gentle rotation of the fetal trunk counterclockwise assists delivery of the right arm, and clockwise rotation assists delivery of the left arm (turning the body "into" the arm). This accomplishes delivery of the arms by drawing them across the fetal chest in a fashion similar to that used for delivery of the legs (Fig. 19.20). These movements cause the fetal elbow to emerge first, followed by the forearm and hand. Once both arms have been delivered, if the vertex has remained flexed on the neck, the chin and face will appear at the outlet (Fig. 19.21).

With further maternal expulsive forces alone, spontaneous controlled delivery of the fetal head often occurs. If not, delivery may be accomplished with a simple manual effort to maximize flexion of the vertex using pressure on the fetal maxilla (not the mandible)—the Mauriceau-Smellie-Veit maneuver—using gentle downward traction along with suprapubic pressure (Credé maneuver; Fig. 19.22). Although maxillary pressure facilitates flexion, the main force effecting delivery remains the mother.

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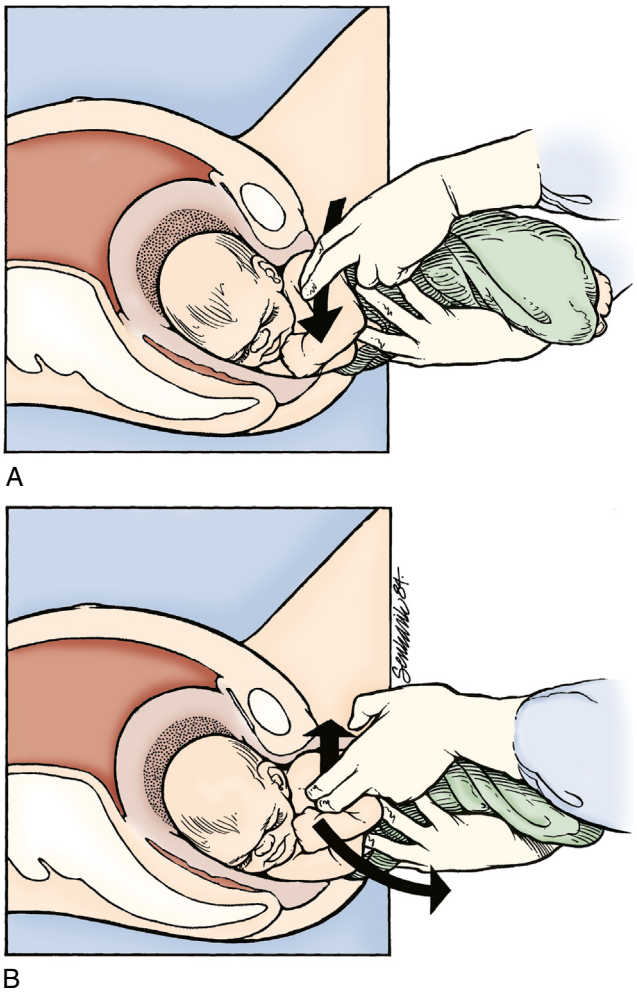

Fig. 19.19 When the scapulae appear under the symphysis, the operator reaches over the left shoulder, sweeps the arm across the chest (A), and delivers the arm (B).

Alternatively, the operator may apply Piper forceps to the aftercoming head.[23] **The application requires *very slight* elevation of the fetal trunk by the assistant, while the operator kneels and applies the Piper forceps from beneath the fetus directly to the fetal head in the pelvis.** Therefore delivery of the breech-presenting fetus should occur on a table/bed capable of allowing the operators to correctly position themselves for the application of forceps. Direct access to the perineum is required. If a delivery bed is used, merely dropping the foot of the bed will be inadequate. The position of the operator for applying the forceps is depicted in Fig. 19.23. Hyperextension of the fetal neck from excessive elevation of the fetal trunk should be avoided because of the potential for spinal cord injury.

Piper forceps are characterized by absence of pelvic curvature. This modification allows *direct* application to the fetal head and avoids conflict with the fetal body that would occur with the application of standard instruments from below. The assistant maintains control of the fetal body while the forceps are inserted into the vagina from beneath the fetus by the primary operator. The blade to be placed on the maternal left is held by the handle in the operator's left hand; the blade is inserted with the operator's right hand in the vagina along the left maternal sidewall and is placed against the right fetal parietal bone. The handle of the right blade is then held in the operator's right hand

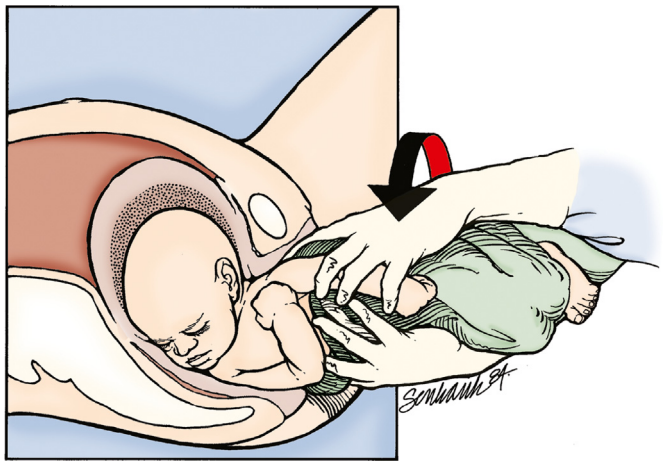

Fig. 19.20 Gentle Rotation of the Shoulder Girdle Facilitates Delivery of the Right Arm.

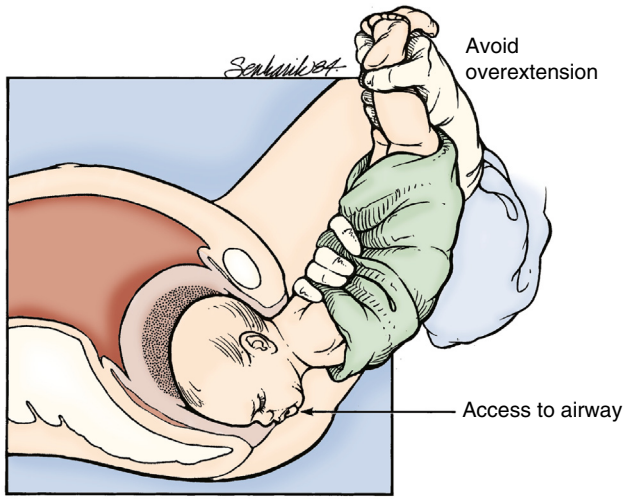

Fig. 19.21 Following Delivery of the Arms, the Fetus is Wrapped in a Towel for Control and Is Slightly Elevated. The fetal face and airway may be visible over the perineum. Excessive elevation of the trunk is avoided.

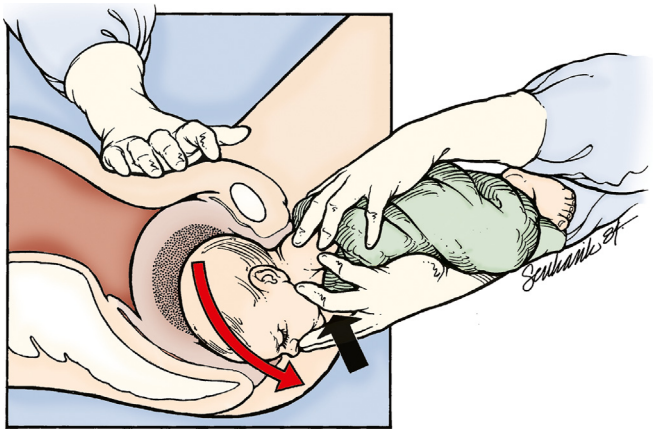

Fig. 19.22 Cephalic Flexion is Maintained by Pressure *(Black Arrow)* on the Fetal Maxilla, *not* the Mandible. Often, delivery of the head is easily accomplished with continued expulsive forces from above and gentle downward traction.

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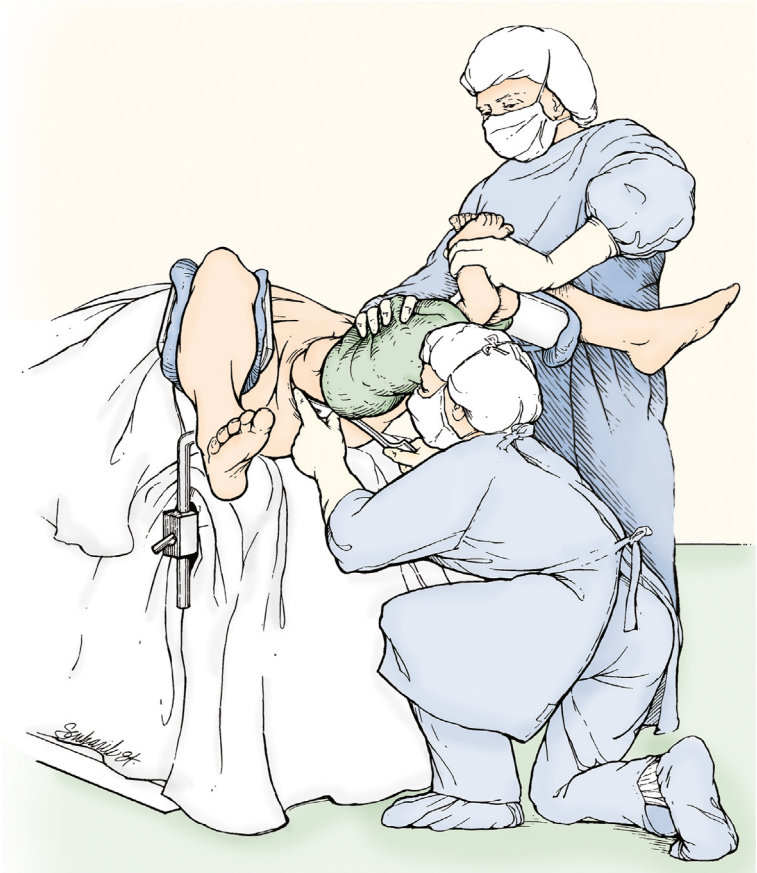

Fig. 19.23 Demonstration of Assistance During the Application of Piper Forceps. The assistant maintains the fetus in a neutral position to avoid the risk associated with hyperextension and possible neurologic injury.

and is inserted by the left hand along the right maternal sidewall and placed against the left fetal parietal bone. Placing the blades in this order facilitates direct locking and avoids the need to reposition the handles. At this point, the assistant allows the fetal body to rest on the shank and handles of the forceps. The primary purpose of Piper forceps is to provide flexion of the fetal head on the neck, not outward traction. Gently raising the handles with the fetal trunk supported on the forceps shanks results in controlled delivery of the vertex (Fig. 19.24). Application of Piper forceps to the aftercoming head may be advisable both to ensure control of the delivery and to maintain optimal operator proficiency in anticipation of more difficult deliveries that may require their use.

Some suggest that oxytocin for induction or augmentation of labor should be avoided with breech presentation. However, induction of labor has generally not been associated with an increase in adverse outcomes in recent large observational studies and is not contraindicated.[24,25] On the other hand, **arrest of spontaneous progress in labor with adequate uterine contractions necessitates consideration of cesarean delivery.** Any evidence of fetal compromise or sustained cord compression on the basis of continuous electronic FHR monitoring also requires consideration of cesarean delivery. Vaginal interventions directed at facilitating delivery of the breech infant complicated by an arrest of spontaneous progress are discouraged because fetal and maternal morbidity and mortality are both greatly increased. However, if labor is deemed to be hypotonic by internally monitored uterine pressures, oxytocin is not contraindicated.[26,27]

Mechanisms of descent and delivery of the incomplete and the complete breech are not unlike those used for the frank breech described earlier; at least one leg may not require attention. The risk of cord prolapse or entanglement is greater, and hence the possibility of emergency cesarean delivery is increased. Furthermore, incomplete and complete breeches may not be as effective as cervical dilators as either the vertex or the larger aggregate profile of the thighs and buttocks of the frank breech. Thus the risk of entrapment of the aftercoming head is increased, and as a result, **primary cesarean delivery is often advocated for nonfrank breech presentations.** However, the randomized trial of Gimovsky and colleagues[28] found vaginal delivery of the nonfrank breech to be reasonably safe.

Contemporary Management of the Term Breech

In the 20 years since publication of the landmark Term Breech Trial (TBT), debate has continued about the proper management of the term breech.[29,30] Other than two small randomized controlled trials (RCTs), most reports prior to publication of the TBT were smaller case series lacking control groups or retrospective cohort studies subject to different sources of bias. In general, these older reports indicated that the PMR for the vaginally delivered breech appeared greater than for its cephalic counterpart, but much of the reported perinatal mortality was due to inclusion of subjects with lethal anomalies and complications of prematurity, both of which are found more frequently among breech infants. Excluding anomalies and extreme prematurity, the corrected perinatal mortality reported by some investigators approached zero regardless of the method of delivery, whereas others

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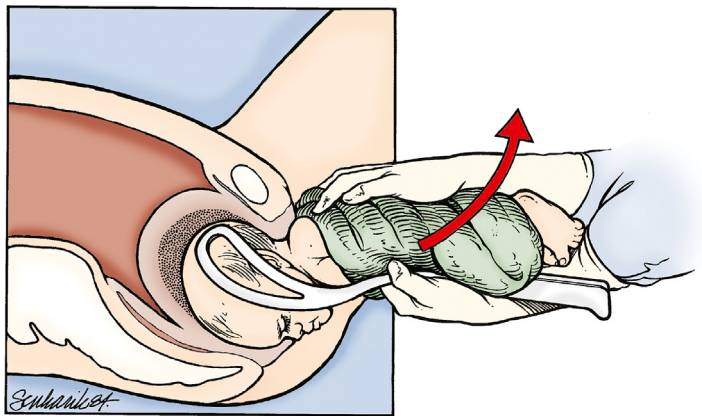

Fig. 19.24 The Fetus May Be Laid on the Piper Forceps and Delivered With a Gentle Upward Motion of the Handles and Fetal Body.

found that even with exclusion of these factors, the term breech infant was found to be at higher risk for birth trauma and asphyxia.

TERM BREECH TRIAL

The impetus for the TBT was a series of retrospective studies that demonstrated increased morbidity and mortality of neonates after vaginal breech delivery, which included neonatal intensive care unit admissions, hyperbilirubinemia, bone fractures, intracranial hemorrhage, neonatal depression,[31] convulsions, and death.[32] However, other studies found that emergent cesarean delivery was also associated with poor neonatal outcomes. Irion and colleagues[33] reported similarly poor neonatal outcomes from cesarean deliveries of 705 singleton breeches and concluded that, as a result of the increased *maternal* morbidity associated with cesarean birth, delivery of the breech infant by cesarean section was not firmly indicated. This opinion was supported by Brown and colleagues[27] in their prospective case series, noting that the corrected PMR did not differ for neonates who weighed 1500 g or more.

In October 2000, the first results from the TBT were published.[29] Overall, 2088 patients from 121 centers in 26 countries with varied national perinatal mortality statistics, according to the World Health Organization, were enrolled in the study. Assignment was random, with 1041 to the planned cesarean delivery group and 1042 to the planned vaginal delivery group. The data were analyzed by the intention-to-treat method, and 941 of 1041 (90.4%) and 591 of 1042 (56.7%) delivered by their intended route of delivery, cesarean delivery and vaginal birth, respectively. Intrapartum events, including cord prolapse and FHR abnormalities, occurred at rates similar to prior studies. Maternal and fetal/neonatal short-term (immediate, 6 weeks, and 3 months) and long-term (2 year) outcome data were presented in this and subsequent reports. For countries with both low and high PMRs, the occurrence of perinatal mortality or serious neonatal morbidity (defined within the report) was significantly lower in the planned cesarean delivery group than in the planned vaginal delivery group (relative risk [RR], 0.33; 95% CI, 0.19 to 0.56; $P < .0001$). In countries with an already low PMR, a proportionately greater risk reduction in PMR was found in the planned cesarean delivery. The effects of operator experience and prolonged labor did not affect the direction of the risk reduction and only marginally affected the amplitude. No differences existed in maternal mortality or serious maternal morbidity between the groups.[29]

The effects on the correlation between labor and delivery factors were assessed in a separate regression analysis that used only delivery mode in one regression and only labor factors—including all other variables such as fetal monitoring, length of labor, and medications—in the other. Mode of delivery and birthweight were both significantly associated with adverse fetal outcome without a significant degree of interaction of these variables. Essentially, smaller infants (<2800 g) were at greatest risk (odds ratio [OR], 2.13; 95% CI, 1.2 to 3.8; $P = .01$). Neonates with birthweights greater than 3500 g showed a trend toward more adverse outcomes, but the trend did not reach significance. The analysis of the labor data shows a "dose-response relationship between the progression of labor and the risk of adverse perinatal outcome," such that **a prelabor cesarean delivery is associated with the lowest rates of adverse outcome compared with vaginal breech delivery.**[34] Maternal outcomes at 3 months showed a reduced rate of urinary incontinence (RR, 0.62; 95% CI, 0.41 to 0.93) in the planned cesarean delivery group,[35] but 2 years after delivery, no differences were found in urinary incontinence or breastfeeding, medical, sexual, social, pain, or reproductive issues.[36] Neonatal outcomes at 2 years showed no difference in mortality rates or neurodevelopmental delay between the planned cesarean delivery and planned vaginal delivery groups.[37] **To summarize the TBT, if a trial of labor is attempted and is successful, babies born by planned vaginal delivery have a small but significant risk of dying or sustaining a debilitating insult in the short term compared with a planned cesarean delivery. If they survive, no difference is seen in the mortality rate or in the presence of developmental delay when compared with children born by planned cesarean delivery.**

The worldwide repercussions of the TBT continue. Eighty of the collaborating centers in 23 of 26 countries responded to a follow-up questionnaire regarding change in practice patterns after the results of the TBT were published. A majority (92.5%) stated that practice had changed, and 85% of respondents reported that an analysis of relative costs would not affect the continued implementation of a policy of planned cesarean delivery for the breech infant at term.[38] A Dutch study examined the effects on delivery statistics and outcomes following the TBT and showed an increase in the cesarean delivery rate for the term breech from 50% to 80%, which was associated with a concomitant reduction in PMR from 0.35% to 0.18%.[39]

Following the TBT, a large prospective cohort analysis was performed at 174 centers in France and Belgium, two countries where the TBT has had only a modest effect on vaginal breech delivery rates.[40]

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Termed the PREMODA trial (*Présentation et Mode d'Accouchement* [Presentation and Mode of Delivery]), it evaluated pregnancy and delivery data—a composite of morbidities, similar to the TBT—from women who gave birth to a fetus, alive or not, from 37 or more weeks. An expert committee not blinded to the mode of delivery evaluated each birth outcome as to whether an elective cesarean delivery at 39 weeks would have prevented the particular outcome. They found that 6 of the 22 fetal deaths and 17 of the 18 neonatal or postneonatal deaths before discharge were due to lethal anomalies; only one death occurred among phenotypically normal fetuses, and this was deemed sudden and unexpected at 15 days of life. In sum, this study noted a global fetal or neonatal mortality risk of 1.59% (95% CI, 1.33 to 1.89); this was not significantly different from the population delivered by planned cesarean. The mortality and serious morbidity rate was significantly less than that of countries with a low PMR rate in the TBT (1.59% vs. 5.7%). Thus in these countries with an already low PMR, excess neonatal morbidity and mortality are not attributed to breech vaginal delivery. However, these results may not be applicable to the United States because the expertise for performing breech vaginal delivery is unfortunately not as available in this country.

As of the time this chapter was written, there have still been only three RCTs of planned vaginal delivery of the term infant. An updated meta-analysis of these trials demonstrated a reduction in perinatal or neonatal death (random effects analysis, RR, 0.29; 95% CI, 0.10 to 0.86) in countries with low and high PMRs.[41] Interestingly, this same meta-analysis demonstrated that by 2 years, there were no differences between groups in "death or neurodevelopmental delay" (RR, 1.09; 95% CI, 0.52 to 2.30) and more infants in the planned cesarean group had medical problems (RR, 1.41; 95% CI, 1.05 to 1.89).[41] Women in the planned cesarean group had more short-term morbidity (RR, 1.29; 95% CI, 1.03 to 1.61) but were similar at 2 years. Of note, the studies included in this most recent meta-analysis did not address the long-term consequences of cesarean delivery, such as maternal morbidity associated with repeat cesarean delivery, surgical complications, or malplacentation, such as placenta previa or accreta spectrum disorders, both of which are significant downstream consequences of a cesarean delivery. In a more recent meta-analysis including the three RCTs, the PREMODA trial, and other large observational studies with a total sample size of more than 250,000, the authors demonstrated that perinatal morbidity and mortality are higher with planned vaginal breech delivery but concluded that absolute rates were low and that individualized decision making about route of delivery of the term breech fetus was appropriate.[42] **Recent large, population-based cohort studies from Canada, Norway, and Sweden, countries where vaginal breech delivery is more common, all report this same finding—increased risks of newborn morbidity and mortality with planned vaginal birth compared to planned cesarean but with small absolute differences.**[43-45] This dynamic is similar to that reported for other challenging decisions at the time of delivery, such as home birth or vaginal birth after cesarean delivery, both with statistically significant but small absolute increases in adverse newborn outcomes and a tendency toward better maternal outcomes. To clarify this, Yeomans and Gilstrap assembled all of the large observational studies published since the TBT with attention to utilization rates, success rates, and newborn morbidity and mortality by ultimate route of delivery.[46] Table 19.2 is modified from Yeomans and Gilstrap with the addition of these three more large population-based studies.[43-45]

Reports published since the TBT on long-term neurologic outcomes and educational attainment of children born after intended vaginal breech delivery are conflicting. Mackay and colleagues relied on linked Scottish birth and educational files from children who were attending school between 2006 and 2012 and suggested that those born by vaginal breech delivery had a slight increase in lower examination attainment compared with those born by planned cesarean delivery (adjusted odds ratio [aOR], 1.16; 95% CI, 1.02 to 1.32, $P = .02$) but found no significant difference in the need for additional educational support (aOR, 1.13; 95% CI, 0.92 to 1.37, $P = .239$).[47] Conversely, two similar large population-based record linkage studies from Australia and Finland show no differences in long-term neurologic outcomes or school-age achievement.[48,49]

Although opinions regarding the ultimate safety of breech vaginal delivery from fetal and maternal standpoints continue to vary, the practical reality today is that intentional vaginal breech delivery is rare in the United States. Between 2005 and 2014, the cesarean delivery rate for breech pregnancies was more than 90%.[50] Even as cesarean delivery is increasingly used as the primary means of delivery of the term breech infant, many still believe that complete abandonment of vaginal delivery for the breech fetus is not yet justified. The TBT also has its detractors, who state that inclusion of fetuses with estimated weights up to 4 kg and less than 2500 g, procedural aberrations in labor assessment and adequacy (length of time permitted for first and second stage of labor, liberal use of induction and augmentation of labor), and worldwide differences in standards of obstetric care and its providers make the trial's results not generalizable. No study is perfect in its methodology or results; this trial has been criticized for its statistical methodology, the ascertainment of expertise, inclusion of both fetal deaths and anomalous fetuses, and the absence of ultrasound from some participating centers, among other flaws.[51] However flawed it may be, the TBT adds to the body of literature on breech vaginal delivery but as such may not be the final answer to the question of the safety of vaginal breech delivery.

Selection of Candidates for Vaginal Breech Delivery

Since the TBT, professional societies have published guidelines to help select appropriate candidates for planned vaginal breech delivery.[52] **Although all are slightly different, there are some common themes among current guidelines. These include informed consent, the use of intrapartum fetal monitoring, the ready availability of cesarean delivery, the presence of at least one attendant skilled in vaginal breech delivery, adequate pelvimetry whether clinical or radiographic, and the absence of contraindications known to increase the risk of fetal injury or difficult delivery, such as a hyperextended fetal neck, fetal macrosomia, a presentation other than frank breech, a low estimated fetal weight, certain fetal anomalies, or antenatal fetal compromise.** Factors generally considered in making a decision to deliver a breech fetus vaginally or by cesarean delivery are listed in Box 19.1. Certainly, **in no case should a woman with an infant presenting as a breech be allowed to labor unless (1) anesthesia coverage is immediately available, (2) cesarean delivery can be undertaken promptly, (3) continuous FHR monitoring is used, and (4) the delivery is attended by a pediatrician and two obstetricians, of whom at least one is experienced with vaginal breech birth.**

Pelvimetry is frequently used when deciding whether to allow a trial of labor in a breech-presenting fetus. Clinical pelvimetry is an acceptable technique that can be used to determine the dimensions of the midpelvis, the outlet, and the inlet by way of surrogate measurement (the obstetric conjugate). The reader is referred to Section III, on Intrapartum Care, and Chapter 13, on normal labor and delivery, for discussion and demonstration of clinical pelvimetry. **Radiographic pelvimetry has been included in the management of the breech presentation with little objective validation.** Regardless, it is expected

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TABLE 19.2 Route of Delivery and Neonatal Outcomes From Reports Published After the Term Breech Trial

Study	Total Breech (*n*)	Prelabor CD	Breech With Labor	Labor CD	VBD	PERINATAL MORBIDITY		PERINATAL MORTALITY	
						VBD	CD	VBD	CD
Lashen, 2002	841	349 (42%)	492 (58%)	238 (48%)	254 (52%)	—	—	2	0
Krupitz, 2005	809	427 (53%)	382 (47%)	98 (26%)	284 (74%)	0.5%	0%	0	0
Pradhan, 2005	1433	552 (38%)	881 (62%)	465 (53%)	416 (47%)	5.9%	0.9%	3	1
Giuliani, 2002	699	218 (31%)	481 (69%)	129 (29%)	352 (71%)	2.3%	0.5%	0	0
Alarab, 2004	641	343 (54%)	298 (46%)	152 (51%)	146 (49%)	0.7%	0%	3	0
Goffinet, 2006	8105	5579 (69%)	2526 (31%)	730 (29%)	1796 (71%)	1.6%	1.4%	2	8
Hopkins, 2007	725	511 (70%)	214 (30%)	76 (36%)	138 (64%)	—	—	0	0
Michel, 2011	1133	711 (63%)	422 (37%)	68 (16%)	354 (84%)	0.5%	0.7%	0	1
Toivonen, 2012	751	497 (66%)	254 (34%)	80 (31%)	174 (69%)	1.2%	0.2%	0	0
Borbolla Foster, 2014	766	523 (68%)	243 (32%)	102 (42%)	141 (58%)	1.6%	0.4%	0	0
Lyons, 2015	52,671	46,313 (88%)	6358 (12%)	4765 (75%)	1593 (25%)	2.9%	0.7%	0	5
Bjelllmo, 2017	16,700	8783 (53%)	7917 (47%)	2356 (30%)	5561 (70%)	—	—	5	9
Eckeus, 2019	27,357	19,205 (70%)	8152 (30%)	6397 (78%)	1755 (22%)	—	—	8	14

CD, Cesarean delivery; *VBD,* vaginal balloon distension.
Modified from Yeomans ER, Gilstrap LC III. Breech delivery. In: Queenan JT, Spong CY, Lockwood CJ, eds. *Queenan's Management of High-Risk Pregnancy: An Evidence-Based Approach*. 6th ed. John Wiley & Sons; 2012:424.

BOX 19.1 Management of Breech Presentation

A trial of labor may be considered if the following conditions are met:
- EFW is between 2000 and 4000 g.
- Presentation is a frank or incomplete breech.
- Maternal pelvis is adequate.
- Fetal neck and head are flexed.
- Fetal monitoring is used.
- Rapid cesarean delivery is possible.
- Good progress is maintained in labor that is adequate.
- An attendant experienced in vaginal breech delivery is available.
- Informed consent is possible.

Cesarean delivery may be prudent if:
- EFW is <1500 g or >4000 g.
- Fetus is in a footling presentation.
- Parturient has a small pelvis.
- Fetal neck and head are hyperextended.
- Expertise in breech delivery is absent.
- A nonreassuring FHR pattern is present.
- Arrest of progress has occurred despite adequate contractions.

EFW, Estimated fetal weight; *FHR,* fetal heart rate.

to predict successful vaginal delivery when adequate pelvic dimensions are present. At least four techniques for pelvimetry are commonly used worldwide: (1) conventional plain-film radiography, using up to three films; (2) CT with up to three views that include lateral, AP, and axial slices; (3) magnetic resonance imaging (MRI); and (4) digital fluorography, which is not presently used in the United States. MRI is the only technique not associated with radiation exposure, and CT pelvimetry using a single lateral view results in the lowest exposure dose. Use of the air-gap technique with conventional radiography will lower the radiation dosage, and current trends show a move toward the lower-dose CT techniques of up to three images. Although the TBT did not require imaging of the pelvis, many of the participating centers used either x-ray or CT pelvimetry. In conjunction with one of the only RCTs of planned vaginal breech delivery, Collea and colleagues suggested the following pelvic dimensions: AP diameter of the inlet, 11 cm; transverse diameter of the inlet, 11.5 cm; AP diameter of the midpelvis (from the promontory of the back of the symphysis, through the ischial spines to the hollow of the sacrum), 11.5 cm; and transverse midpelvis (bispinous diameter), 10 cm.[26]

To offer a planned vaginal breech delivery, the clinician must possess the necessary training and experience in the procedure. Furthermore, the relationship between the patient and the clinician should be well established, and the discussions of risks and benefits must be objective and nondirective, with accurate documentation of the discussion. If any of these factors are lacking, cesarean delivery becomes the safer choice. However, even if a clinician has made the choice that they will *never* prospectively offer a patient with breech presentation a trial of labor, the burden of responsibility to know and understand the mechanism and management of a breech delivery is not relieved. No one active in obstetrics will avoid the occasional emergency breech delivery. Regular review of principles and practice with simulations using a mannequin and model pelvis with an experienced colleague can increase the skills and improve the performance of anyone facing such an emergency. With a cesarean delivery rate for term breech fetuses in the United States currently more than 90%, there is a vicious cycle of fewer providers providing the service and fewer willing to teach the procedure. One partial solution, and a critical element for any provider who might be faced with an unexpected vaginal breech delivery, is simulation. A 2006 study[53] of

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resident skill before and after simulation training showed universal improvement in technique and performance of key maneuvers required for vaginal delivery of a breech fetus when such maneuvers were performed in mock emergency settings using a Noelle pelvic trainer (Gaumard Scientific, Miami, FL).

Special Clinical Circumstances and Risks: Preterm Breech, Hyperextended Head, and Footling Breech

The various categories of breech presentation clearly demonstrate dissimilar risks, and management plans might vary among these situations. **The premature breech, the breech with a hyperextended head, and the footling breech are categories that have high rates of fetal morbidity or mortality. Complications associated with incomplete dilation and cephalic entrapment may be more frequent. For these three breech situations, in general, cesarean delivery appears to optimize fetal outcome and is therefore recommended.**

As with term breech infants, the role of cesarean delivery for improving outcomes among breech infants with low and very low birthweights is controversial. Although most deaths in those with a very low birthweight are due to prematurity or lethal anomalies, cesarean delivery has been shown by most authors to improve outcomes and decrease corrected perinatal mortality in this weight group compared with results in similar-sized vertex presentations.[54-57] However, the improvements in outcome with cesarean delivery in the preterm breech fetus may be more nuanced. A study of more than 8300 preterm singleton breech deliveries between 26 and 36 weeks' gestation demonstrated no significant difference in overall perinatal mortality with cesarean versus vaginal delivery but did show improvements in mortality between 28 and 32 weeks (1.7% vs. 4.1%; aOR, 0.27; 95% CI, 0.10 to 0.77), and significant reductions in the composite of perinatal mortality or major morbidity (5.9% vs. 10.1%; aOR, 0.37; 95% CI, 0.20 to 0.68).[56] Conversely, other observational studies, including follow-up to 2 years after birth, do not show clear improvements in outcomes with cesarean delivery for the preterm breech fetus.[58-60] Other authors suggest that improved survival in these studies relates to improved neonatal care of the premature infant when compared with the outcomes of historical controls. However, when vaginal delivery of the preterm breech fetus is chosen or is unavoidable, older studies have demonstrated reduced fetal morbidity and mortality when conduction anesthesia and Piper or Laufe forceps are used for delivery of the aftercoming head.

Preterm premature rupture of membranes (PPROM) is associated with prematurity and chorioamnionitis, both of which have been found to be independent risk factors for the development of cerebral palsy (CP). PPROM is associated with a high rate of malpresentation because of prematurity and decreased amniotic fluid. Knowing the association of chorioamnionitis with periventricular leukomalacia (PVL), a lesion found to precede development of CP in the premature neonate, Baud and colleagues[61] correlated the mode of delivery with PVL and subsequent CP in breech preterm deliveries. **The authors found that in the presence of chorioamnionitis, delivery by planned cesarean section was associated with a significant decrease in the incidence of PVL.**

Hyperextension of the fetal head during vaginal breech delivery has been consistently associated with a high (21%) risk of spinal cord injury. It is important to differentiate simple deflexion of the head from clear hyperextension, given that Ballas and colleagues demonstrated that simple deflexion carries no excess risk.[62] Deflexion of the fetal vertex, as opposed to hyperextension, is similar to the relationship between the occipitofrontal cranial plane and the axis of the fetal cervical spine illustrated in Fig. 19.5. Often, as labor progresses, spontaneous flexion will occur in response to fundal forces.

Finally, the footling breech carries a prohibitively high (16% to 19%) risk of cord prolapse during labor. In many cases, cord prolapse manifests only late in labor, after commitment to vaginal delivery may have been made. Cord prolapse necessitates prompt cesarean delivery. Furthermore, the footling breech is a poor cervical dilator, and cephalic entrapment becomes more likely.

Breech Second Twin

Approximately one-third of all twin gestations present as cephalic/breech—that is, the first twin is a cephalic presentation and the second is a breech (see also Chapter 39). **The management alternatives in the case of the cephalic/breech twin pregnancy in labor include cesarean delivery, vaginal delivery of the first twin, and either attempted ECV or IPV and breech extraction of the second twin.** Blickstein and colleagues[63] compared the obstetric outcomes of 39 cases of vertex/breech twins with the outcomes of 48 vertex/vertex twins. Although the breech second twin had a higher incidence of low birthweight and a longer hospital stay, the authors found no basis for elective cesarean delivery in this clinical circumstance. The outcomes of another study[64] of 136 pairs of cephalic/noncephalic twins weighing more than 1500 g allow us to conclude that breech extraction of the second twin appears to be a safe alternative to cesarean delivery. Laros and Dattel[65] studied 206 twin pairs and similarly found no clear advantage to arbitrary cesarean delivery because of a specific presentation. When comparing outcomes of 390 vaginally delivered second twins (207 delivered vertex, 183 delivered breech), with 95% of the breech deliveries being total breech extractions, it was noted that no significant differences existed between the cephalic and breech infants even when stratified by birthweight.[66] These outcomes assume the skills and experience required to perform a successful breech extraction. A Danish retrospective evaluation[67] of IPV for a noncephalic second twin demonstrated that, although it occurs only rarely, IPV is associated with fewer asphyxiated neonates than second twins delivered by cesarean delivery after a vaginal delivery of the first twin; in addition, a trend was seen toward higher cord pH and higher Apgar scores in the IPV group. The disturbing trend highlighted by this study is the very high chance of the vaginal and cesarean combination delivery.

The Twin Birth Study,[68] a multicenter randomized trial, showed that cesarean delivery of twins demonstrated neither a decrease nor an increase in the rate of fetal or neonatal death or morbidity compared with vaginal delivery. The authors of this study advocate that patients seek out providers who are skilled in the vaginal birth of the second twin. However, for any clinician uncomfortable with the prospective vaginal delivery of a singleton breech, cesarean delivery may be a safer option for the pregnancy with a noncephalic-presenting second twin.

If IPV/extraction of the second twin is to be performed, it can be facilitated by ultrasonic guidance. A hand is inserted into the uterus, both fetal feet are identified and grasped with the membranes intact, and traction is applied to bring the feet into the pelvis and out the introitus, with maternal expulsive efforts remaining the major force in effecting descent of the fetus. The membranes are left intact until both feet are at the introitus. Once the membranes are ruptured, the delivery is subsequently managed as a footling breech delivery. If the operator has difficulty identifying the fetal feet, intrapartum ultrasound may be of assistance.

During breech extraction, and perhaps more often with a breech extraction of a smaller twin, the fetal head can become entrapped in

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the cervix. In such cases, the operator's entire hand is placed in the uterus, the fetal head is cradled, and as the hand is withdrawn, the head is protected.[69] This splinting technique has also been used for the safe extraction of the breech head at the time of cesarean delivery. Head entrapment may also occur because of increased uterine tone or contractions. In this case, **a uterine relaxing agent may be used, with nitroglycerin 50 to 200 μg intravenously being one of the fastest-acting, safest agents in appropriately selected patients.** Terbutaline or inhalational anesthesia may also be used.

Despite publication and broad awareness among practitioners of the Twin Birth Study clearly establishing the safety of planned vaginal birth of the well-selected nonvertex second twin, many remain reluctant to offer and perform the procedure.[70] Here again, with a dwindling cadre of experienced providers and willing teachers, the procedure is at risk of falling out of favor and availability despite proven safety. As with planned vaginal breech delivery, simulation may be one method of addressing the problem of provider confidence and competence. Several groups have published descriptions of moderately high-fidelity simulation systems for the teaching and training of delivery of the nonvertex second twin.[71,72] Finally, supporting the continued teaching and training of vaginal delivery of the noncephalic second twin, Schmitz and colleagues have shown no difference in outcomes for infants when the second twin is delivered vaginally by supervised residents when compared to faculty physicians.[73]

Absent a provider skilled and experienced in IPV and breech extraction, vaginal delivery of the first twin followed by external version of the second is a viable alternative, using ultrasound in the delivery room to directly visualize the fetus. Often a transient decrease in uterine activity occurs after the delivery of the first infant, which can be used to advantage in the performance of a cephalic version. A report with 30 noncephalic second twins (12 transverse and 18 breech) shows that version after birth of the first twin was successful in 11 of the 12 infants in a transverse lie and in 16 of the 18 breech infants.[74] These twins were all older than 35 weeks' gestation, with intact membranes of the second twin after delivery of the first, no evidence of anomalies, and normal amniotic fluid volume.

External Cephalic Version

ECV is recommended for the breech fetus at 36 to 37 weeks' gestation.[75,76] Many have found that ECV significantly reduces the incidence of breech presentation in labor and is associated with few complications such as cord compression or placental abruption.[75] In general, **reported success with ECV varies from 50% to 75%, and a similar percentage of these remain vertex at the time of labor.** Although many infants in breech presentation before 34 weeks' gestation will convert spontaneously to a cephalic presentation, the percentage of those that spontaneously convert decreases as term approaches. In a randomized trial[76] of ECV in low-risk pregnancies between 37 and 39 weeks' gestation, success was achieved in 68% of 25 cases in the version group, whereas only 4 of the 23 controls converted to a vertex spontaneously before labor. All of those in whom external version was successful presented in labor as a vertex. In a recent meta-analysis of eight studies with more than 1300 women randomized, the Cochrane group noted significant and meaningful reduction in noncephalic presentation at birth (RR, 0.42; 95% CI, 0.29 to 0.61) and cesarean section (RR, 0.57; 95% CI, 0.40 to 0.82).[77]

The optimal time for ECV is between 36 and 39 weeks. The timing of ECV was evaluated in the early ECV2 trial,[78] published in 2011. Although a greater percentage of ECVs performed early (34 weeks to 35 weeks, 6 days gestational age), as opposed to those performed late (at or beyond 37 weeks' gestation), were cephalic at the time of delivery, no difference was found in the rate of cesarean delivery between the two groups. The additional detractor from doing an early ECV is that the rate of late preterm births did increase. In a subsequent cost analysis from this study, the authors concluded that early ECV (before 36 weeks) results in higher costs than when performed later.[79] Other groups have also noted higher success rates with earlier ECV, but no difference in cesarean delivery rates when comparing early versus later ECV.[80] Given the balance between risks of prematurity and a higher likelihood of success at earlier gestational ages, we routinely offer ECV at 36 to 38 weeks. If the ECV is successful in this window of time and there are no indications for delivery, we prefer to await spontaneous labor. In a prospective observational study, Burgos and colleagues demonstrated that **awaiting spontaneous labor after a successful ECV greatly improved the chances of vaginal delivery compared with immediate induction of labor** (91.5% vs. 75.4%, $P < .001$).[81]

Outcomes of pregnancies after ECV prove that it is a safe and effective intervention.[75] Fetal complications include abruption, a nonreassuring FHR pattern, rupture of the membranes, cord prolapse, spontaneous conversion back to breech, and fetomaternal hemorrhage. Maternal complications other than discomfort during the procedure are rare. Several authors have reported that, although the cesarean rate is clearly lower with a successful ECV than without, the cesarean rate is not reduced compared to that of women presenting with a vertex fetus who never required an ECV.[82,83]

Gentle, constant pressure applied in a relaxed patient, together with frequent FHR assessments, is the element of ECV success stressed by all investigators.[76] Methodology varies, although the "forward roll" is more widely supported than the "back flip" (Fig. 19.25).[76] The mechanical goal is to squeeze the fetal breech up and out of the pelvis, then the fetal vertex gently out of the fundal area to the transverse and finally the lower segment of the uterus.

A number of factors predict success of ECV with reliability. Successful version is reported more often in parous than in nulliparous women and more often with attempts at 37 to 39 weeks' gestation than after 40 weeks. A study in 2010 by Burgos and colleagues[81] demonstrated increased rates of successful ECV at approximately 37 weeks' gestation with parity greater than two (OR, 3.74; 95% CI, 2.37 to 5.9), posterior placental location (OR, 2.85; 95% CI,1.87 to 4.36), and double footling breech as opposed to frank breech (OR, 2.77; 95% CI, 1.16 to 6.62). Complete breech also showed increased odds of success but not to the extent of double-footling breech. Normal or abundant amniotic fluid volume also improves the probability of success of ECV. Two studies[84,85] demonstrated better results when the amniotic fluid index (AFI) exceeded 7 cm. Factors on the day of the procedure that may also affect the success rate favorably include an unengaged fetal breech and an easily palpable fetal head.[86,87]

Tocolysis, regional anesthesia, and ultrasound during ECV may also be helpful. Use of a number of tocolytics has been reported, including ritodrine (no longer available in the United States), hexoprenaline, salbutamol (albuterol), nitroglycerine, and terbutaline. A randomized trial[88] of 103 nulliparous patients found that the success rate with subcutaneous terbutaline was 52%, compared with 27% in the control group, and no adverse maternal effects resulting from the drug were found. A Cochrane database study of the effects of tocolysis (and other interventions) for ECV was performed and reported in 2015.[89] It reviewed 28 studies with data on 2786 women. Tocolytics, in particular β-mimetics, increased the rate of cephalic presentation at term (RR, 1.68; 95% CI, 1.14 to 2.48) and reduced the cesarean delivery rate (RR, 0.75; 95% CI, 0.67 to 0.88). Despite a black box warning from the US Food and Drug Administration on the use of

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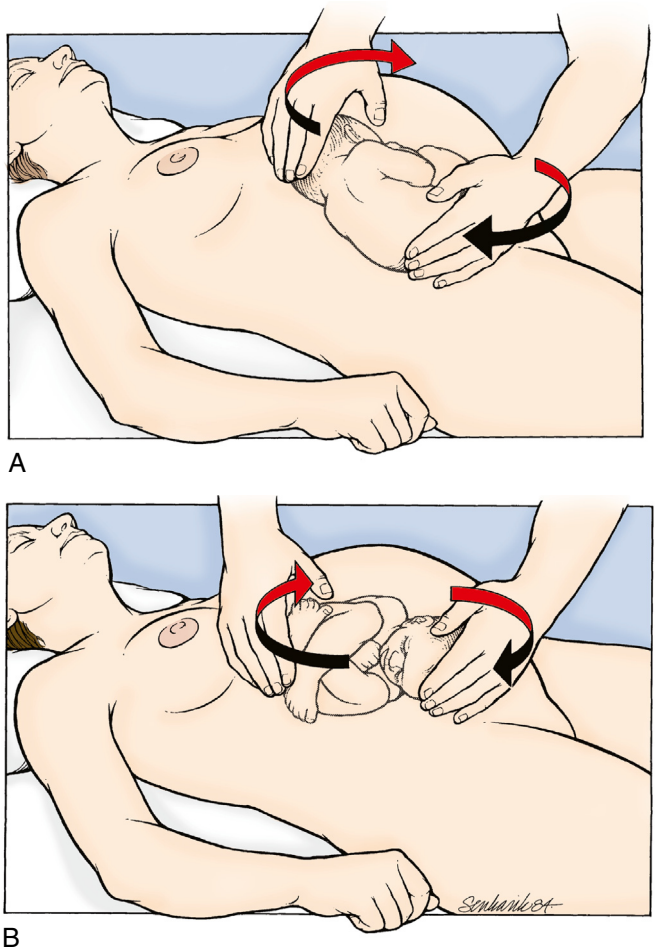

Fig. 19.25 External cephalic version is accomplished by gently "squeezing" the fetus out of one area of the uterus and into another. Illustrated here is the popular "forward roll."

terbutaline, this remains the most commonly used tocolytic drug to aid ECV. We generally administer terbutaline 0.25 mg subcutaneously approximately 15 to 20 minutes before attempting an ECV.

The use of regional anesthesia for ECV has also been controversial. Some believe that operators might apply excessive pressure to the maternal abdomen when epidural anesthesia is used, which might make fetal compromise more likely, as indicated by FHR decelerations and possibly related to placental abruption. However, a randomized trial[90] of ECV in 69 women using epidural anesthesia demonstrated a better than twofold increase in the success of the procedure when an epidural was used. Disparate results are demonstrated when combined spinal-epidural (CSE) analgesia or spinal anesthesia is used. A randomized study[91] of nulliparas undergoing ECV showed a fourfold improvement in the success of ECV and a reduced visual analog pain score with spinal anesthesia compared with no anesthetic. Another randomized trial[92] of CSE anesthesia at analgesic doses versus systemic opioids showed no difference in the rates of successful ECV. This trial had an overall low rate of successful ECV (39%) and a low rate in each arm of the study (47% in the CSE and 31% in the opioid arms, respectively), and the participation of 47 physicians suggests the possibility of highly varied skill levels across the providers. This trial specifically aimed to determine whether analgesia, as opposed to anesthesia, improves success. **A recent meta-analysis clearly demonstrated that regional anesthesia increases the likelihood of a successful ECV.** Magro-Malosso and colleagues conducted a meta-analysis including nine clinical trials with more than 900 women and reported that use of neuraxial anesthesia for ECV is associated with an increased success rate (58% vs. 43%; RR, 1.44; 95% CI, 1.27 to 1.64), a higher likelihood of cephalic presentation in labor (55% vs. 40%; RR, 1.37; 95% CI, 1.08 to 1.73) and ultimately, vaginal delivery (54% vs. 45%; RR, 1.21; 95% CI, 1.04 to 1.41).[93] Importantly, in this meta-analysis maternal discomfort and visual analog pain scales were significantly reduced with neuraxial analgesia. Despite clear evidence that regional analgesia improves success rates and decreases maternal discomfort, there are logistical and resource considerations involved with placement of a regional analgesic. As such, we generally reserve this intervention for women who express a strong preference for this or for women choosing a second attempt prior to a planned cesarean delivery for breech presentation.

On the adverse side, factors associated with failure of ECV included obesity, deep pelvic engagement of the breech fetus, oligohydramnios, and posterior positioning of the fetal back. Fetomaternal transfusion has been reported to occur in up to 6% of patients undergoing external version[94]; thus **Rh-negative unsensitized women should receive Rho(D) immune globulin.** Quantitation of fetomaternal hemorrhage with the Kleihauer-Betke (acid elution) assay or flow cytometry test will determine the number of vials of Rho(D) immune globulin to be administered.

In the case of the gravida with a previous cesarean delivery, ECV has also been controversial. Studies of limited sample size have concluded that ECV is safe for mother and fetus and that it results in increased rates of vaginal delivery. Success rates of up to 82% in patients with a previous cesarean delivery have been reported.[95] Use of intravenous ritodrine tocolysis in 11 patients with a history of a previous low cervical transverse cesarean delivery resulted in no uterine dehiscences found clinically or at the time of cesarean delivery.[96] A 2009 study by Sela and colleagues[97] that included a review of the world literature (of singleton fetuses without anomalies at 36 or more weeks' gestation, all retrospective studies) found ECV success rates in multiparas that ranged between 65.8% and 100% (mean, 76.6%) in patients with a single prior cesarean delivery. Prior successful vaginal delivery was predictive of higher success rates for ECV overall, and no excess morbidity/mortality or asymptomatic scar dehiscence was noted in these patients. The largest study of complication rates from ECV included patients with a prior cesarean delivery, but neither the success nor complication rates for this subgroup were reported; descriptions of overall complications included no case of overt uterine rupture or scar dehiscence.[98] More recently, Impey and colleagues described their own prospective series of 100 ECVs among women with a prior cesarean delivery and included 549 additional cases from the literature and noted no occurrences of uterine rupture or perinatal death.[99] In light of this favorable experience, a prior cesarean delivery is neither a relative nor absolute contraindication to an attempted ECV. Although there are currently limited recommendations for patients with two prior cesarean deliveries to attempt a trial of labor after cesarean (see Chapter 22), data are not available regarding success rates and complications of ECV in this population.

Acupuncture and moxibustion of acupuncture point BL 67 (Zhiyin, which lies beside the outer corner of the fifth toenail) have been studied in relation to converting the noncephalic presenting fetus, and a Cochrane review[100] on this topic has been published. Although early studies demonstrated benefit of these therapies, this review of eight

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studies with data on 1346 women showed that moxibustion alone did not reduce noncephalic presentation compared with no treatment. However, in comparison with acupuncture, moxibustion proved to be superior (RR, 0.25; 95% CI, 0.09 to 0.72), but in *combination* with acupuncture, a reduction was noted in both noncephalic presentations (RR, 0.73; 95% CI, 0.57 to 0.94) and cesarean deliveries (RR, 0.79; 95% CI, 0.64 to 0.98). A recent RCT from Finland with 200 women randomized either to moxibustion daily for 2 weeks or usual care showed no significant effect on the incidence of breech presentation among nulliparous or parous women.[101] Another RCT from France explored the effect of acupuncture versus a sham control among more than 250 women between 32 and 34 weeks and noted no effect.[102] Even though the balance of current evidence suggests little to no effect of these interventions, the roles of complementary and alternative medicine and traditional techniques in modern medicine remain to be further examined.

ABNORMALITIES OF POSITION: OCCIPUT POSTERIOR AND OCCIPUT TRANSVERSE

Occiput posterior (OP) and occiput transverse are abnormalities of position rather than presentation. Persistent OP occurs when the occiput of a vertex fetus persists in the posterior quadrants of the maternal pelvis through the second stage and to the point at which delivery occurs or is indicated. The incidences of OP and occiput transverse vary depending on the time in labor at which position is ascertained. OP is more common in early labor and the active phase, is still common at the onset of the second stage, and persists until delivery in approximately 5% to 10% of cases in modern studies.[103-106] From studies relying on ultrasound throughout labor, it appears that 50% of fetuses begin labor in the transverse position and approximately a quarter each in the occiput anterior (OA) and OP positions. Approximately 80% to 90% of fetuses noted to be OP early in labor will rotate spontaneously before delivery.[103,106,107] Of those beginning the second stage in an OP position, approximately 50% to 80% will rotate spontaneously before delivery.

Factors predisposing to persistent OP include nulliparity, body mass index greater than 30, macrosomia, the need for augmentation of labor, anterior placental location, race, pelvic architecture, and epidural analgesia.[106,108-110] The contribution of epidural analgesia to persistent OP has been a matter of debate. Well-conducted observational studies relying on ultrasound clearly support a predisposing effect, but a meta-analysis of randomized trials of epidural analgesia for labor suggests that the effect is only modest (RR, 1.40; 95% CI, 0.98 to 1.99).[111] No combination of factors predicts persistent OP well enough to be useful clinically.

Maternal morbidity associated with persistent OP is more significant than fetal or newborn morbidity. Maternal outcomes associated with persistent OP include longer first and second stages of labor[104,109,112] and increased risks of cesarean delivery[113,114] and operative vaginal delivery.[115-117] When a fetus delivers OP, the fetal vertex is relatively extended and the diameter that must pass through the introitus and over the perineal body is the occipitomental diameter, as opposed to the suboccipitobregmatic diameter when delivering OA. Because the former diameters are 3 to 4 cm greater than the latter, vaginal delivery in the OP position is associated with increased rates of third- and fourth-degree lacerations. Large observational studies suggest an aOR for obstetric anal sphincter injury with delivery from the OP position. Reporting from the National Institute of Child Health and Human Development Pelvic Floor Disorders Network, Fitzgerald and colleagues noted a sevenfold increase in the risk of sphincter injury with vaginal delivery in the OP position.[118] Even with cesarean delivery, maternal morbidity is increased with persistent OP. The risk of significant extensions of the hysterotomy at the time of cesarean delivery are doubled with persistent OP.[119] Fetal and newborn morbidity associated with persistent OP includes modest increases in lower Apgar scores, cord gas acidemia, meconium, birth trauma, and neonatal intensive care unit admission. However, a large observational study demonstrated that when adjusting for other factors, the only fetal morbidity that remained significantly associated with persistent OP was a slight increase in birth trauma related to operative vaginal delivery (aOR, 1.77; 95% CI, 1.22 to 2.57).[120]

Diagnosis of Occiput Posterior

The diagnosis of persistent OP by vaginal examination alone is challenging. Large observational studies relying on ultrasound as the gold standard confirm that physical exam for determination of the position of the occiput in the active phase is so inaccurate as to be of little clinical value even among experienced clinicians.[121-125] These studies and others suggest that **bedside ultrasound for determination of the position of the occiput in the second stage is highly accurate and very reproducible (>99%), versus approximately 80% with physical exam** (Fig. 19.26).[126]

Prevention of Persistent Occiput Posterior

There are no interventions proven to be effective for the prevention of OP before labor. A randomized trial with 2500 women demonstrated that a program of maternal hands and knees positioning with pelvic rocking from 37 weeks until delivery had no effect on the rate of persistent OP (8.1% in the treatment group vs. 7.8% in the control group).[127] Although commonly recommended, the majority of RCTs have shown no effect of purposeful maternal positioning during labor for the prevention or treatment of persistent OP in the active phase or during the second stage.[128-131] None of these trials showed harm from such positioning, and some suggest improvements in maternal comfort levels.

For many years the recommended approach to OP early in the second stage was simple observation and conservative management without intervention.[132-134] This was largely due to the recognition that most fetuses in the OP position would rotate spontaneously. In addition, these recommendations were from an era with little utilization of epidural analgesia for labor when the rate of persistent OP was generally 5% or less. Currently, with contemporary rates of persistent OP closer to 10%, active intervention and management of OP early in the second stage have been advocated as one possible means of decreasing cesarean delivery rates.[135] **Recognizing that manual or digital rotation becomes more difficult and less likely to be successful the longer OP persists in the second stage, several authors have advocated prophylactic manual or digital rotation early in the second stage to prevent persistent OP and its consequences.** Recent retrospective observational studies suggest that prophylactic manual rotation is effective in decreasing persistent OP, cesarean delivery for persistent OP, and operative vaginal delivery.[136-139] In a prospective clinical trial assigned by time cohorts, Reichman and colleagues studied the effectiveness of a plan for prophylactic manual rotation of OP fetuses after an initial period of observation in the second stage (nulliparas were allowed 1 hour before attempted rotation; multiparous women were allowed 30 minutes).[140] Compared with usual care, this treatment approach resulted in significant improvements in OA at delivery (93% vs. 15%, $P < .001$) and in spontaneous vaginal delivery (77% vs. 27%, $P < .001$), fewer operative vaginal deliveries (23% vs. 50%, $P < .001$), and fewer cesarean

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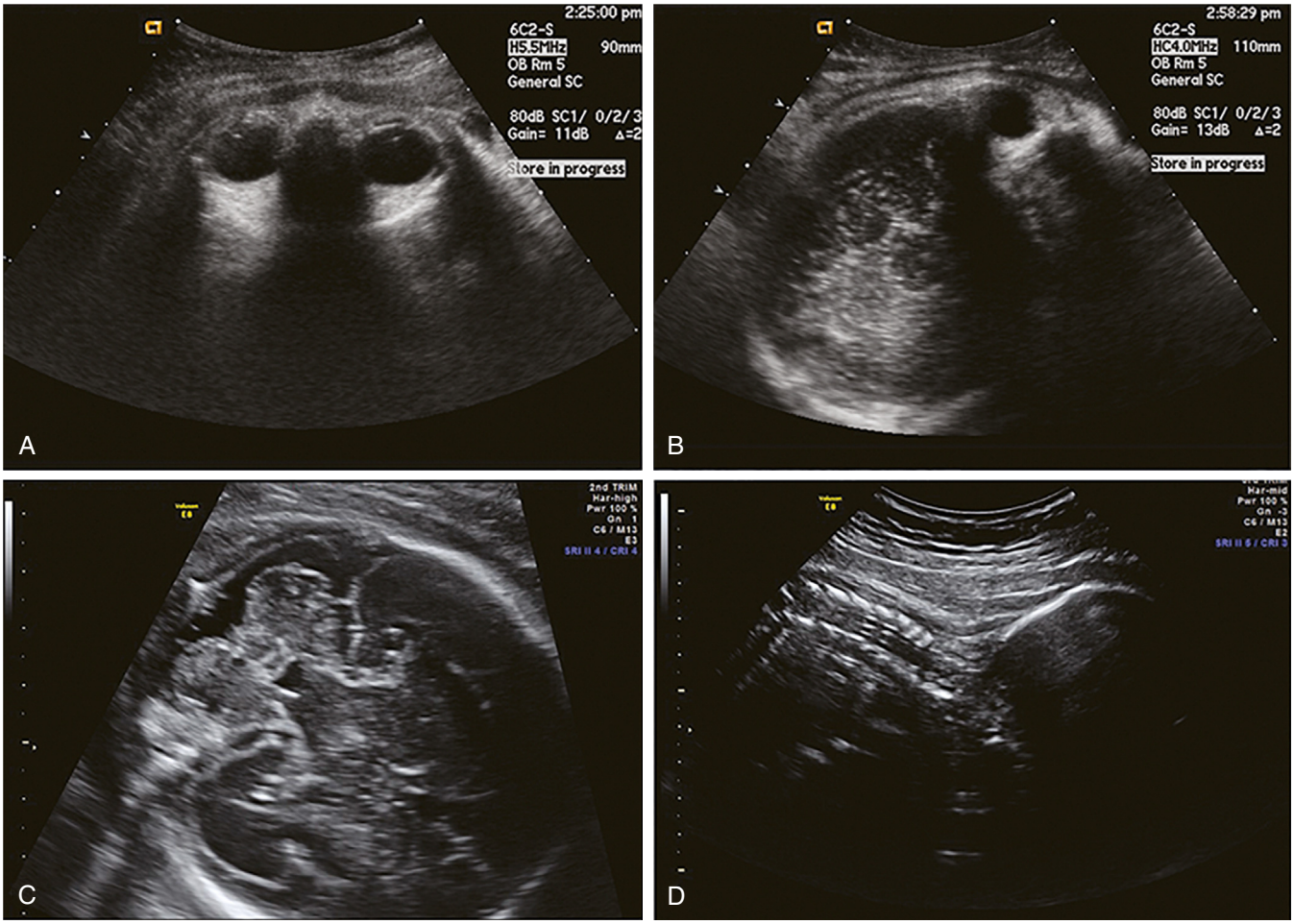

Fig. 19.26 Transabdominal Ultrasound Determination of the Fetal Occiput. A, Direct occiput posterior with both fetal orbits facing the transducer. B, Right occiput posterior with the fetal orbits facing anteriorly to the maternal left. C, Right occiput anterior with the fetal cerebellum seen anteriorly to the maternal right. D, Occiput anterior by localization of the fetal spine in the sagittal plane. (From Barth WH Jr. Persistent occiput posterior. *Obstet Gynecol*. 2015;125:695-709.)

deliveries (0% vs. 23%, $P < .001$). However, the study was limited because the control group had significantly higher rates of induction and augmentation of labor, epidural use, and episiotomy. Conclusions regarding the effectiveness and utility of prophylactic manual rotation for the prevention of persistent OP must await the conclusion and publication of ongoing randomized trials.[141,142]

The technique for manual or digital rotation is illustrated in Fig. 19.27.[143] Manual and digital rotation of the fetal occiput is more likely to be successful if performed earlier in the second stage than waiting for an arrest of descent. Success rates are generally reported to be 80% to 90% early in the second stage and only 30% or less if performed in the setting of an arrest of descent. To facilitate manual rotation, it is best to position the patient almost as though readying for delivery, with the foot of the bed dropped and the maternal legs supported. Rotation is attempted between maternal contractions and without pushing. If resistance to rotation is encountered, slight flexion of the fetal head or slight destationing may help. Care should be exercised with the latter maneuver to avoid the rush of amniotic fluid and cord prolapse.

When delivery is indicated for an OP fetus in the second stage either for arrest of descent or maternal or fetal indications, a stepwise approach shown in Fig. 19.28 is recommended. **Contraindications to operative vaginal delivery in the setting of persistent OP include suspected fetal macrosomia, palpation of the fetal BPD above the pelvic inlet as detected by Leopold maneuvers, absence of any requirement for safe operative vaginal delivery** (see Chapter 13), **or features of an android pelvis with a crowded anterior segment, forward sacrum, and prominent ischial spines.**[143] If any of these are present, cesarean delivery is indicated. Similarly, in the setting of a category III FHR tracing, some suggest proceeding with cesarean delivery because successful operative vaginal delivery cannot be guaranteed and cesarean delivery may be performed more quickly.[144] Otherwise, operative vaginal delivery may be considered. If a careful exam of the pelvis suggests anthropoid features with more room in the posterior segment of the pelvis than the anterior segment, operative vaginal delivery should proceed without rotation. However, if the pelvis is deemed to have gynecoid features with ample room anteriorly, a hollow sacrum, and blunt or lateral spines, consideration may be given to operative vaginal delivery with rotation, either manual or instrumental. Manual rotation is performed as described previously, followed by immediate forceps or vacuum delivery.

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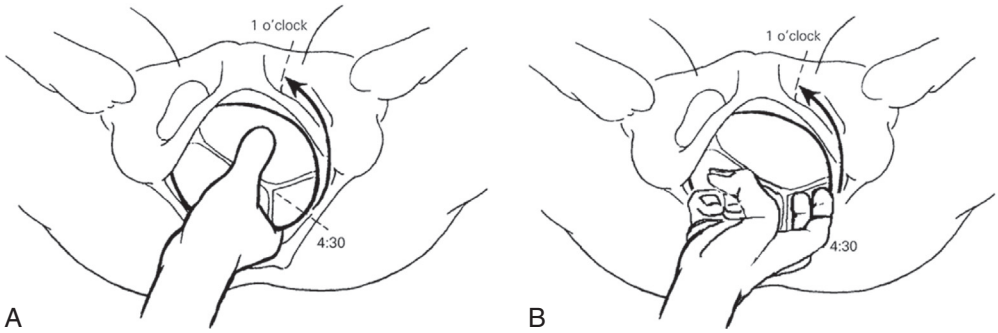

Fig. 19.27 Rotation of Left Occiput Posterior to Left Occiput Anterior. (A) Manual rotation of left occiput posterior to left occiput anterior. With the right hand facing palm up, four fingers are placed inferiorly and spread across the left side of the fetal head with the thumb on the right side. While flexing the fetal head, the operator rotates the occiput counterclockwise into the anterior segment of the pelvis. (B) Digital rotation of left occiput posterior to left occiput anterior. The index and middle fingers are used to locate and apply counterclockwise pressure in a dialing motion on the posterior margin of the right parietal bone at the right lambdoidal suture. (From Barth WH Jr. Persistent occiput posterior. *Obstet Gynecol*. 2015;125:695-709.)

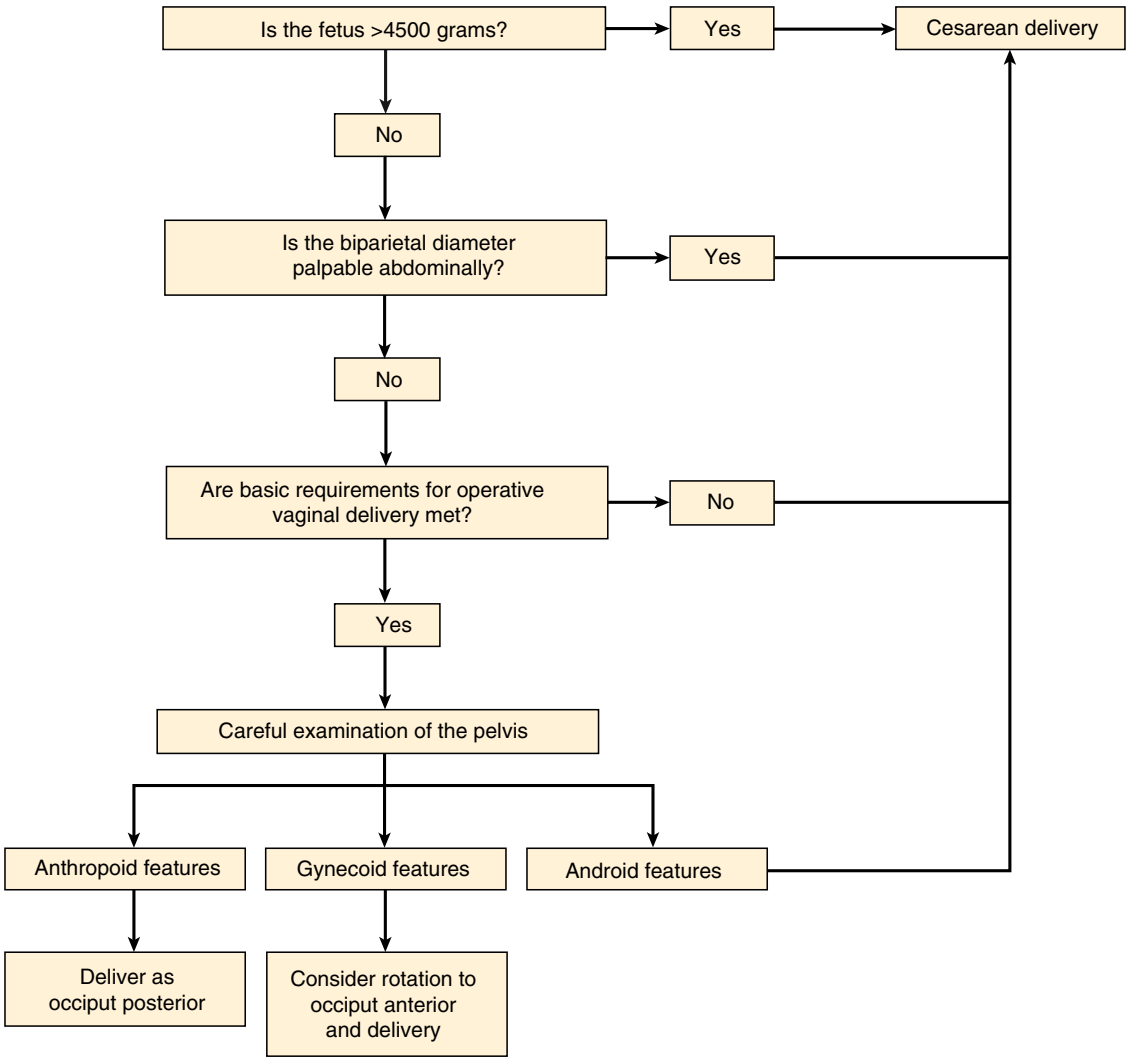

Fig. 19.28 Suggested Approach to Arrest of Descent in the Second Stage With Persistent Occiput Posterior. (From Barth WH Jr. Persistent occiput posterior. *Obstet Gynecol*. 2015;125:695-709.)

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Rotational forceps deliveries have become less common due to many factors, but primarily a lack of experience among graduating residents and a declining cadre of willing teachers.[145,146] However, large cohort studies suggest a continuing role for rotational forceps in contemporary practice.[147-151] These modern studies, generally from institutions that still teach and practice Kielland rotational deliveries, demonstrate success rates of up to 90% and decreased rates of third- and fourth-degree lacerations, decreased rates of failed operative vaginal delivery, and no differences in neonatal morbidity compared with nonrotational vacuum, forceps, or second-stage cesarean delivery. Although older studies suggested concern for fetal spinal cord injury with rotational forceps, there were no such injuries in the 2966 rotational deliveries included in these studies (0 of 2966 [0%]; 95% CI, 0.0 to 0.16%). Conduct of a rotational operative delivery with Kielland forceps is similar to that described elsewhere in this text for transverse positions, but the application is simpler. For rotations from OP, the forceps are applied with a cephalic application with the buttons on the handles toward the fetal face; rotation is gentle between contractions, moving the fetal head 180 degrees in the direction of the fetal spine (counterclockwise for left OP, clockwise for right OP). If the rotation is successful, the Kielland forceps are removed and replaced with traditional forceps such as Simpson forceps for completion of the delivery. Alternatively, some prefer to apply the Kielland forceps inverted from below the perineum such that the pelvic curve of the blades aligns with the curvature of the pelvis on completion of rotation. With this method the Kielland forceps are kept in place through traction and delivery with care not to raise the handles above the horizontal in order to minimize the risk of vaginal lacerations.

When compared with cesarean delivery before full cervical dilation, second-stage cesarean delivery is associated with increased maternal morbidity often related to inadvertent extensions of the hysterotomy into the cervix or laterally into the uterine arteries.[152,153] The risk of such an extension is doubled when the fetus is OP.[154] This and the difficulty sometimes encountered in extracting the fetus with a deeply impacted fetal head have led some to propose pulling the fetus from above as a breech rather than relying on a hand from below to push the fetal head up. A meta-analysis of six prospective and four retrospective observational studies demonstrated a significant increase in the risk of hysterotomy extensions with the push compared with the pull and reverse breech methods.[155] However, fetal injuries were more common with pull methods. When cesarean delivery is needed for arrest of descent with a persistent OP, we place the patient in Allen stirrups in a low lithotomy position to afford better access to gently destation the vertex prior to the cesarean section or intraoperatively if needed, and resort to a reverse breech delivery or pull technique only if this fails.

KEY POINTS

- *Fetal lie* refers to the orientation of the fetal spine relative to that of the mother. Normal fetal lie is longitudinal and by itself does not connote whether the presentation is cephalic or breech.
- Cord prolapse occurs 20 times as often with an abnormal axial lie as it does with a cephalic presentation.
- Fetal malformations are observed in more than half of infants with a face presentation.
- Fetal malpresentation requires timely diagnostic exclusion of major fetal or uterine malformations and/or abnormal placentation.
- A closely monitored labor with vaginal delivery is a safe possibility with face or brow malpresentations. However, cesarean delivery is the only acceptable alternative if normal progress toward spontaneous vaginal delivery is not observed.
- ECV of the infant in breech presentation near term is a safe and often successful management option. Use of tocolytics and epidural anesthesia may improve success.
- Appropriate training and experience of pediatric team members are prerequisites to the safe vaginal delivery of selected infants in breech presentation.
- In experienced hands, women with twins presenting vertex/nonvertex can undergo a trial of labor because this management has similar maternal and perinatal outcomes to a planned cesarean delivery.
- A simple compound presentation may be permitted a trial of labor as long as labor progresses normally with reassuring fetal status. However, compression or reduction of the fetal part may result in injury.
- The diagnosis of persistent OP can be improved by verifying findings on physical examination with simple bedside ultrasound during labor.
- If the fetus persists in an OP position after an initial period of conservative management in the second stage, manual or digital rotation in the direction of the fetal spine may improve maternal and fetal outcomes.
- In experienced hands, rotational forceps deliveries for persistent OP are associated with improved maternal outcomes and fetal outcomes similar to nonrotational operative vaginal delivery and cesarean delivery.

REFERENCES

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REFERENCES

1. Stallworthy J. The dangerous placenta. *Am J Obstet Gynecol*. 1951;61:720–737.
2. Thorp JM, Jenkins T, Watson W. Utility of Leopold maneuvers in screening for malpresentation. *Obstet Gynecol*. 1991;78:394–396.
3. Sharma JB. Evaluation of Sharma's modified Leopold's maneuvers: a new method for fetal palpation in late pregnancy. *Arch Gynecol Obstet*. 2009;279:481–487.
4. Phelan JP, Boucher M, Mueller E, McCart D, Horenstein J, Clark SL. The nonlaboring transverse lie. A management dilemma. *J Reprod Med*. 1986;31:184–186.
5. Hankins GDV, Hammond TL, Snyder RR, Gilstrap 3rd LC. Transverse lie. *Am J Perinatol*. 1990;7:66–70.
6. Benedetti TJ, Lowensohn RI, Truscott AM. Face presentation at term. *Obstet Gynecol*. 1980;55:199–202.
7. Duff P. Diagnosis and management of face presentation. *Obstet Gynecol*. 1981;57:105–112.
8. Schwartz Z, Dgani R, Lancet M, Kessler I. Face presentation. *Aust N Z J Obstet Gynaecol*. 1986;26:172–176.
9. Hartnick CJ, Barth Jr WH, Coté CJ, Albrecht MA, Grant PE, Geyer JT. Case records of the Massachusetts General Hospital, Case 7-2009, A pregnant woman with a large mass in the fetal oral cavity. *N Engl J Med*. 2009;360:913–921.
10. Levy DL. Persistent brow presentation: a new approach to management. *South Med J*. 1976;69:191–192.
11. Bashiri A, Berstein E, Bar-David J, Levy A, Mazor M. Face and brow presentation: independent risk factors. *J Matern Fetal Neonatal Med*. 2008;21:357–360.
12. Ingolfsson A. Brow presentations. *Acta Obstet Gynecol Scand*. 1969;48:486–496.
13. Breen JL, Wiesmeier E. Compound presentation: a survey of 131 patients. *Obstet Gynecol*. 1968;32(3):419–422.
14. Weissberg SM, O'Leary JA. Compound presentation of the fetus. *Obstet Gynecol*. 1973;41(1):60.
15. Quinlivan WL. Compound presentation. *Can Med Assoc J*. 1957;76(8):633–635.
16. Chan DP. A study of 65 cases of compound presentation. *Br Med J*. 1961;2(5251):560.
17. Tebes CC, Mehta P, Calhoun DA, Richards DS. Congenital ischemic forearm necrosis associated with a compound presentation. *J Matern Fetal Med*. 1999;8(5):231.
18. Kwok CS, Judkins CL, Sherratt M. Forearm injury associated with compound presentation and prolonged labour. *J Neonatal Surg*. 2015;4(3):40 [Epub 2015 Jul 1].
19. Byrne H, Sleight S, Gordon A, Sella D, Abrahams Y. Unusual rectal trauma due to compound fetal presentation. *J Obstet Gynaecol*. 2006;26(2):174–175.
20. Collea JV. Current management of breech presentation. *Clin Obstet Gynecol*. 1980;23:525–531.
21. Lubusky M, Prochazka M, Langova M, Vomackova K, Cizek L. Discrepancy in ultrasound biometric parameters of the head (HC—head circumference, BPD—biparietal diameter) in breech presented fetuses. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub*. 2007;151:323–326.
22. Kasby CB, Poll V. The breech head and its ultrasound significance. *Br J Obstet Gynaecol*. 1982;89:106–110.
23. Piper EB, Bachman C. The prevention of fetal injuries in breech delivery. *JAMA*. 1929;92:217–221.
24. Macharey G, Ulander VM, Heinonen S, Nuutila M, Vaisanen-Tomminska M. Induction of labor in breech presentations at term: a retrospective observational study. *Arch Gynecol Obstet*. 2016;293:549–5455.
25. Gaillard T, Girault A, Alexander S, Goffinet F, Le Ray C. Is induction of labor a reasonable option for breech presentation? *Acta Obstet Gynecol Scand*. 2019;98:885–893.
26. Collea JV, Chein C, Quilligan EJ. The randomized management of term frank breech presentation: a study of 208 cases. *Am J Obstet Gynecol*. 1980;137:235–244.
27. Brown L, Karrison T, Cibils LA. Mode of delivery and perinatal results in breech presentation. *Am J Obstet Gynecol*. 1994;171:28–34.
28. Gimovsky ML, Wallace RL, Schifrin BS, Paul RH. Randomized management of the non-frank breech presentation at term: a preliminary report. *Am J Obstet Gynecol*. 1983;146:34–40.
29. Hannah ME, Hannah WJ, Hewson SA, Hodnett ED, Saigal S, Willan AR. Planned caesarean section versus planned vaginal birth for breech presentation at term: a randomised multicentre trial. Term Breech Trial Collaborative Group. *Lancet*. 2000;356:1375–1383.
30. Joseph KS, Pressey T, Lyons J, et al. Once more into the breech: planned vaginal delivery compared with planned cesarean delivery. *Obstet Gynecol*. 2015;125:1162–1167.
31. Diro M, Puangsricharern A, Royer L, O'Sullivan MJ, Burkett G. Singleton term breech deliveries in nulliparous and multiparous women: a 5-year experience at the University of Miami/Jackson Memorial Hospital. *Am J Obstet Gynecol*. 1999;181:247–252.
32. Roman J, Bakos O, Cnattingius S. Pregnancy outcomes by mode of delivery among term breech births: Swedish experience 1987-1993. *Obstet Gynecol*. 1998;92:945–950.
33. Irion O, Hirsbrunner Almagbaly P, Morabia A. Planned vaginal delivery versus elective caesarean section: a study of 705 singleton term breech presentations. *Br J Obstet Gynaecol*. 1998;105:710–717.
34. Su M, McLeod L, Ross S, et al. Factors associated with adverse perinatal outcome in the Term Breech Trial. *Am J Obstet Gynecol*. 2003;189:740–745.
35. Hannah ME, Hannah WJ, Hodnett ED, et al. Outcomes at 3 months after planned cesarean vs planned vaginal delivery for breech presentation at term: the international randomized Term Breech Trial. *JAMA*. 2002;287:1822–1831.
36. Hannah ME, Whyte H, Hannah WJ, et al. Maternal outcomes at 2 years after planned cesarean section versus planned vaginal birth for breech presentation at term: the international randomized Term Breech Trial. *Am J Obstet Gynecol*. 2004;191:917–927.
37. Whyte H, Hannah ME, Saigal S, et al. Outcomes of children at 2 years after planned cesarean birth versus planned vaginal birth for breech presentation at term: the International Randomized Term Breech Trial. *Am J Obstet Gynecol*. 2004;191:864–871.
38. Hogle KL, Kilburn L, Hewson S, Gafni A, Wall R, Hannah ME. Impact of the international term breech trial on clinical practice and concerns: a survey of centre collaborators. *J Obstet Gynaecol Can*. 2003;25:14–16.
39. Rietberg CC, Elferink-Stinkens PM, Visser GH. The effect of the Term Breech Trial on medical intervention behaviour and neonatal outcome in The Netherlands: an analysis of 35,453 term breech infants. *BJOG*. 2005;112:205–209.
40. Goffinet F, Carayol M, Foidart JM, et al. Is planned vaginal delivery for breech presentation at term still an option? Results of an observational prospective survey in France and Belgium. *Am J Obstet Gynecol*. 2006;194:1002–1011.
41. Hofmeyr GJ, Hannah M, Lawrie T. Planned caesarean section for term breech delivery. *Cochrane Database Syst Rev*. 2019;2019(5). http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=coch&NEWS=N&AN=00075320-100000000-00317.
42. Berhan Y, Haileamlak A. The risks of planned vaginal breech delivery versus planned caesarean section for term breech birth: a meta-analysis including observational studies. *BJOG*. 2016;123:49–57.
43. Lyons J, Pressey T, Bartholomew S, Liu S, Liston RM, Joseph KS. For the Canadian perinatal Surveillance system (public health agency of Canada). Delivery of breech presentation at term gestation in Canada, 2003-2011. *Obstet Gynecol*. 2015;125:1153–1161.
44. Bjellmo S, Anderson GL, Martinussen MP, et al. Is vaginal breech delivery associated with higher risk for perinatal death and cerebral palsy compared to vaginal cephalic birth? Registry-based cohort study in Norway. *BMJ Open*. 2017;7(4):e014979.
45. Ekéus C, Norman M, Aberg K, Winberg S, Stolt K, Aronsson A. Vaginal breech delivery at term and neonatal morbidity and mortality – a population-based cohort study in Sweden. *J Matern Fetal Neonatal Med*. 2019;32:265–270.
46. Yeomans ER, Gilstrap III LC. Breech delivery. In: Queenan JT, Spong CY, Lockwood CJ, eds. *Queenan's Management of High-Risk Pregnancy: An Evidence-Based Approach*. 6th ed. Oxford: John Wiley & Sons; 2012:424.

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47. Mackay DF, Wood R, King A, et al. Educational outcomes following breech delivery: a record-linkage study of 456,947 children. *Int J Epidemiol*. 2015;44:209–217.
48. Bergenhenegouwen L, Vlemmix F, Ensing S, et al. Preterm breech presentation: a comparison of intended vaginal and intended cesarean delivery. *Obstet Gynecol*. 2015;126:1223–1230.
49. Grabovac M, Karim JN, Isayama T, Liyanage SK, McDonald SD. What is the safest mode of birth for extremely preterm breech singleton infants who are actively resuscitated? A systematic review and meta-analyses. *BJOG*. 2018;125:652–663.
50. Hehir MP, Ananth CV, Siddiq Z, Flood K, Friedman AM, D'Alton ME. Cesarean delivery in the United States 2005 through 2014: a population-based analysis using the Robson 10-Group Classification System. *Am J Obstet Gynecol*. 2018;219:105.e1–105.e11.
51. Lawson GW. The term breech trial ten years on: primum non nocere? *Birth*. 2012;39:3–9.
52. Tsakiridis I, Mamopoulos A, Athanasiadis A, Dagklis T. Management of breech presentation: a comparison of four national evidence-based guidelines. *Am J Perinatol*. 2019;37:1102–1109.
53. Deering S, Brown J, Hodor J, Satin AJ. Simulation training and resident performance of singleton vaginal breech delivery. *Obstet Gynecol*. 2006;107:86–89.
54. Ulstein M. Breech delivery. *Ann Chir Gynaecol*. 1980;69:70–74.
55. Demirci O, Tugrul AS, Turgut A, Ceylan S, Eren S. Pregnancy outcomes by mode of delivery among breech births. *Arch Gynecol Obstet*. 2012;285:297–303.
56. Duenhoelter JH, Wells CE, Reisch JS, Santos-Ramos R, Jimenez JM. A paired controlled study of vaginal and abdominal delivery of the low birth weight breech fetus. *Obstet Gynecol*. 1979;54:310–313.
57. Grabovac M, Karim JN, Isayama T, Liyanage SK, McDonald SD. What is the safest mode of birth for extremely preterm breech singleton infants who are actively resuscitated? A systematic review and meta-analyses. *BJOG*. 2018;125:652–663.
58. Wolf H, Schaap AH, Bruinse HW, Smolders-de Haas H, van Ertbruggen I, Treffers PE. Vaginal delivery compared with caesarean section in early preterm breech delivery: a comparison of long term outcome. *Br J Obstet Gynaecol*. 1999;106:486–491.
59. Kayem G, Baumann R, Goffinet F, et al. Early preterm breech delivery: is a policy of planned vaginal delivery associated with increased risk of neonatal death? *Am J Obstet Gynecol*. 2008;198:289.e1–289.e6.
60. Lorthe E, Sentilhes L, Quere M, et al, EPIPAGE-2 Obstetric Writing Group. Planned delivery route of preterm breech singletons, and neonatal and 2-year outcomes: a population-based cohort study. *BJOG*. 2019;126:73–82.
61. Baud O, Ville Y, Zupan V, et al. Are neonatal brain lesions due to intrauterine infection related to mode of delivery? *Br J Obstet Gynaecol*. 1998;105:121–124.
62. Ballas S, Toaff R, Jaffa AJ. Deflexion of the fetal head in breech presentation. Incidence, management, and outcome. *Obstet Gynecol*. 1978;56:653–655.
63. Blickstein I, Schwartz-Shoham Z, Lancet M. Vaginal delivery of the second twin in breech presentation. *Obstet Gynecol*. 1987;69:774.
64. Gocke SE, Nageotte MP, Garite T, Towers CV, Dorcester W. Management of the nonvertex second twin: primary cesarean section, external version, or primary breech extraction. *Am J Obstet Gynecol*. 1989;161:111–114.
65. Laros RK, Dattel BJ. Management of twin pregnancy: the vaginal route is still safe. *Am J Obstet Gynecol*. 1988;158:1330–1338.
66. Fishman A, Grubb DK, Kovacs BW. Vaginal delivery of the nonvertex second twin. *Am J Obstet Gynecol*. 1993;168:861–864.
67. Jonsdottir F, Henriksen L, Secher NJ, Maaloe N. Does internal podalic version of the non-vertex second twin still have a place in obstetrics? A Danish national retrospective cohort study. *Acta Obstet Gynecol Scand*. 2015;94:59–64.
68. Barrett JF, Hannah ME, Hutton EK, et al. A randomized trial of planned cesarean or vaginal delivery for twin pregnancy. *N Engl J Med*. 2013;369:1295–1305.
69. Druzin ML. Atraumatic delivery in cases of malpresentation of the very low birth weight fetus at cesarean section: the splint technique. *Am J Obstet Gynecol*. 1986;154:941–942.
70. Easter SR, Taouk L, Schulkin J, Robinson JN. Twin vaginal delivery: innovate or abdicate. *Am J Obstet Gynecol*. 2017;216:484–488.
71. Lepage J, Ceccaldi PF, Remini SA, Plaisance P, Voulgaropoulos A, Luton D. Twin vaginal delivery: to maintain skill – simulation is required. *Eur J Obstet Gynecol Reprod Biol*. 2019;234:195–199.
72. Cornette JMJ, Erkamp JS. Internal podalic version and breech extraction: enhancing realistic sensations in a simulation model. *Obstet Gynecol*. 2018;131:360–363.
73. Schmitz T, Korb D, Azria E, et al. JUMODA Study Group and the Groupe de Recherche en Obstetrique et Gynecologie. Neonatal morbidity after management of vaginal noncephalic second-twin delivery by residents. *Obstet Gynecol*. 2018;132:1377–1385.
74. Tchabo JG, Tomai T. Selected intrapartum external cephalic version of the second twin. *Obstet Gynecol*. 1992;79:421–423.
75. Zhang J, Bowes WA, Fortney JA. Efficacy of external cephalic version: a review. *Obstet Gynecol*. 1993;82:306–312.
76. Van Dorsten JP, Schifrin BS, Wallace RL. Randomized control trial of external cephalic version with tocolysis in late pregnancy. *Am J Obstet Gynecol*. 1981;141:417–424.
77. Hofmeyer GJ, Kulier R, West HM. External cephalic version for breech presentation at term. *Cochrane Database Syst Rev*. 2015;4:CD000083.
78. Hutton EK, Hannah ME, Ross SJ, et al. The Early External Cephalic Version (ECV) 2 Trial: an international multicentre randomised controlled trial of timing of ECV for breech pregnancies. *BJOG*. 2011;118:564–577.
79. Ahmed RJ, Gafni A, Hutton EK, for the Early ECV2 Trial Collaborative Group Collaborators. The cost implications in Ontario, Alberta, and British Columbia of early versus delayed external cephalic version in the Early External Cephalic Version 2 (EECV2) trial. *J Obstet Gynaecol Can*. 2016;38:235–245.
80. Lavie A, Reicher L, Avraham S, Ram M, Maslovitz S. Success rates of early versus late initiation of external cephalic version. *Int J Gynaecol Obstet*. 2019;145:116–121.
81. Burgos J, Melchor JC, Pijoan JI, Cobos P, Fernandez-Llebrez L, Martinez-Astorquiza T. A prospective study of the factors associated with the success rate of external cephalic version for breech presentation at term. *Int J Gynaecol Obstet*. 2011;112:48–51.
82. Vezina Y, Bujold E, Varin J, Marquette GP, Boucher M. Cesarean delivery after successful external cephalic version of breech presentation at term: a comparative study. *Am J Obstet Gynecol*. 2004;190:763–768.
83. Boujenah J, Fleury C, Bonneau C, Pharisien I, Tigaizin A, Carbillon L. Successful external cephalic version is an independent factor for caesarean section during trial of labor – a matched controlled study. *J Gynecol Obstet Hum Reprod*. 2017;46:737–742.
84. Tasnim N, Mahmud G, Khurshid M. External cephalic version with salbutamol - success rate and predictors of success. *J Coll Physicians Surg Pak*. 2009;19:91–94.
85. Ben-Meir A, Erez Y, Sela HY, Shveiky D, Tsafrir A, Ezra Y. Prognostic parameters for successful external cephalic version. *J Matern Fetal Neonatal Med*. 2008;21:660–662.
86. Hutton EK, Simioni JC, Thabane L. Predictors of success of external cephalic version and cephalic presentation at birth among 1253 women with non-cephalic presentation using logistic regression and classification tree analyses. *Acta Obstet Gynecol Scand*. 2017;96:1012–1020.
87. Isakov O, Reicher L, Lavie A, Yogev Y, Maslovitz S. Prediction of success in external cephalic version for breech presentation at term. *Obstet Gynecol*. 2019;133:857–866.
88. Fernandez CO, Bloom SL, Smulian JC, Ananth CV, Wendel GD. A randomized placebo-controlled evaluation of terbutaline for external cephalic version. *Obstet Gynecol*. 1997;90:775–779.
89. Cluver C, Gyte GM, Sinclair M, Dowswell T, Hofmeyr GJ. Interventions for helping to turn term breech babies to head first presentation when using external cephalic version. *Cochrane Database Syst Rev*. 2015;2:CD000184.

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90. Schorr SJ, Speights SE, Ross EL, et al. A randomized trial of epidural anesthesia to improve external cephalic version success. *Am J Obstet Gynecol*. 1997;177:1133–1137.
91. Weiniger CF, Ginosar Y, Elchalal U, Sharon E, Nokrian M, Ezra Y. External cephalic version for breech presentation with or without spinal analgesia in nulliparous women at term: a randomized controlled trial. *Obstet Gynecol*. 2007;110:1343–1350.
92. Sullivan JT, Grobman WA, Bauchat JR, et al. A randomized controlled trial of the effect of combined spinal-epidural analgesia on the success of external cephalic version for breech presentation. *Int J Obstet Anesth*. 2009;18:328–334.
93. Magro-Malosso ER, Saccone G, Di Tommaso M, Mele M, Berghella V. Neuraxial analgesia to increase the success rate of external cephalic version: a systematic review and meta-analysis of randomized controlled trials. *Am J Obstet Gynecol*. 2016;215:276–286.
94. Marcus RG, Crewe-Brown H, Krawitz S, Katz J. Feto-maternal haemorrhage following successful and unsuccessful attempts at external cephalic version. *Br J Obstet Gynaecol*. 1975;82:578–580.
95. Flamm BL, Fried MW, Lonky NM, Giles WS. External cephalic version after previous cesarean section. *Am J Obstet Gynecol*. 1991;165:370–372.
96. Schachter M, Kogan S, Blickstein I. External cephalic version after previous cesarean section—a clinical dilemma. *Int J Gynaecol Obstet*. 1994;45:17–20.
97. Sela HY, Fiegenberg T, Ben-Meir A, Elchalal U, Ezra Y. Safety and efficacy of external cephalic version for women with a previous cesarean delivery. *Eur J Obstet Gynecol Reprod Biol*. 2009;142:111–114.
98. Collins S, Ellaway P, Harrington D, Pandit M, Impey LW. The complications of external cephalic version: results from 805 consecutive attempts. *BJOG*. 2007;114:636–638.
99. Impey ORE, Greenwood GEL, Impey LWM. External cephalic version after previous cesarean section: a cohort study of 100 consecutive attempts. *Eur J Obstet Gynecol Reprod Biol*. 2018;231:210–213.
100. Coyle ME, Smith CA, Peat B. Cephalic version by moxibustion for breech presentation. *Cochrane Database Syst Rev*. 2012;5:CD003928.
101. Bue L, Lauszus FF. Moxibustion did not have an effect in a randomized clinical trial for version of breech presentation. *Dan Med J*. 2016;63(2).
102. Sananes N, Roth GE, Aissi GA, et al. Acupuncture version of breech presentation: a randomized sham-controlled single-blinded trial. *Eur J Obstet Gynecol Reprod Biol*. 2016;204:24–30.
103. Gardberg M, Laakonen E, Salevaara M. Intrapartum sonography and persistent occiput posterior position: a study of 408 deliveries. *Obstet Gynecol*. 1998;91:746–749.
104. Ponkey SE, Cohen AP, Heffner LJ, Lieberman E. Persistent fetal occiput posterior position: obstetric outcomes. *Obstet Gynecol*. 2003;101:915–920.
105. Akmal S, Tsoi E, Howard R, Osei E, Nicholaides KH. Investigation of occiput posterior delivery by ultrasonography. *Ultrasound Obstet Gynecol*. 2004;24:425–428.
106. Lieberman E, Davidson K, Lee-Paritz A, Shearer E. Changes in fetal position during labor and their association with epidural analgesia. *Obstet Gynecol*. 2005;105:974–982.
107. Peregrine E, O'Brien P, Jauniaux E. Impact on delivery outcome of ultrasonographic fetal head position prior to induction of labor. *Obstet Gynecol*. 2007;109:618–625.
108. Gardberg M, Stenwall O, Laakonen E. Recurrent persistent occipitoposterior position in subsequent deliveries. *BJOG*. 2004;111:170–171.
109. Cheng YW, Shaffer BL, Caughey AB. Associated factors and outcomes of persistent occiput posterior position: a retrospective cohort study from 1976 to 2001. *J Matern Fetal Neonatal Med*. 2006;19:563–568.
110. Sizer AR, Nirmal DM. Occipitoposterior position: associated factors and obstetric outcome in nulliparas. *Obstet Gynecol*. 2000;96:749–752.
111. Anim-Somuah M, Smyth RMD, Jones L. Epidural versus nonepidural or no analgesia in labour. *Cochrane Database Syst Rev*. 2011;12:CD000331.
112. Fitzpatrick M, McQuillan K, O'Herlihy C. Influence of persistent occiput posterior position on delivery outcome. *Obstet Gynecol*. 2001;98:1027–1031.
113. Senécal J, Xiong X, Fraser WD. Pushing Early or Pushing Late with Epidural Study Group. Effect of fetal position on second stage duration and labor outcome. *Obstet Gynecol*. 2005;105:763–772.
114. Peregrine E, O'Brien P, Omar R, Janiaux E. Clinical and ultrasound parameters to predict the risk of cesarean delivery after induction of labor. *Obstet Gynecol*. 2006;107:227–233.
115. Fraser WD, Cayer M, Soeder BM, Turcot L, Marcoux S. PEOPLE (Pushing Early or Pushing Late with Epidural) Study Group. Risk factors for difficult delivery in nulliparas with epidural analgesia in second stage of labor. *Obstet Gynecol*. 2002;99:409–418.
116. Hawkins JL, Hess KR, Kubicek MA, Joyce III TH, Morrow DH. A reevaluation of the association between instrument delivery and epidural analgesia. *Reg Anesth*. 1995;20:50–56.
117. Mazouni C, Porcu G, Bretelle F, Loundou A, Heckenroth H, Gamerre M. Risk factors for forceps delivery in nulliparous patients. *Acta Obstet Gynecol Scand*. 2006;85:298–301.
118. Fitzgerald MP, Weber AM, Howden N, Cundiff GW, Brown MB. Pelvic Floor Disorders Network. Risk factors for anal sphincter tear during vaginal delivery. *Obstet Gynecol*. 2007;109:29–34.
119. de la Torre L, González-Quintero VH, Mayor-Lynn K, et al. Significance of accidental extensions in the lower uterine segment during cesarean delivery. *Am J Obstet Gynecol*. 2006;194:e4–e6.
120. Cheng YW, Shaffer BL, Caughey AB. The association between persistent occiput posterior position and neonatal outcomes. *Obstet Gynecol*. 2006;107:837–844.
121. Sherer DM, Miodovnik M, Bradley KS, Langer O. Intrapartum fetal head position II: comparison between transvaginal digital examination and transabdominal ultrasound assessment during the second stage of labor. *Ultrasound Obstet Gynecol*. 2002;19:264–268.
122. Akmal S, Kametas N, Tsoi E, Heargraves C, Nicolaides KH. Comparison of transvaginal digital examination with intrapartum sonography to determine fetal head position before instrumental delivery. *Ultrasound Obstet Gynecol*. 2003;21:437–440.
123. Chou MR, Kreiser D, Taslimi MM, Druzin ML, El-Sayed YY. Vaginal ultrasound examination of fetal occiput position during the second stage of labor. *Am J Obstet Gynecol*. 2004;191:521–524.
124. Dupuis O, Ruimark S, Corinne D, Simone T, André D, René-Charles R. Fetal head position during the second stage of labor: comparison of digital vaginal examination and transabdominal ultrasonographic examination. *Eur J Obstet Gynecol Reprod Biol*. 2005;123:193–197.
125. Zahalka N, Sadan O, Malinger G, et al. Comparison of transvaginal sonography with digital examination and transabdominal sonography for the determination of fetal head position in the second stage of labor. *Am J Obstet Gynecol*. 2005;193:381–386.
126. Akmal S, Tsoi E, Nicolaides KH. Intrapartum sonography to determine fetal occipital position; interobserver agreement. *Ultrasound Obstet Gynecol*. 2004;24:421–424.
127. Kariminia A, Chamberlain MF, Keogh J, Shea A. Randomized controlled trial of effect of hands and knees posturing on incidence of occiput posterior position at birth. *BMJ*. 2004;328:490.
128. Hunter S, Hofmeyr GJ, Kulier R. Hands and knees posture in late pregnancy or labour for fetal malposition (lateral or posterior). *Cochrane Database Syst Rev*. 2007;4:CD001063.
129. Stremler R, Hodnett E, Petryshen P, Stevens B, Weston J, Willan AR. Randomized controlled trial of hands-and-knees positioning for occipitoposterior position in labor. *Birth*. 2005;32:243–251.
130. Desbriere R, Blanc J, Le Dû R, et al. Is maternal posturing during labor efficient in preventing persistent occiput posterior position? A randomized controlled trial. *Am J Obstet Gynecol*. 2013;208:60.e1–60.e8.
131. Guittier MJ, Othenin-Girard V, de Gasquet B, Irion O, Boulvain M. Maternal positioning to correct occiput posterior fetal position during the first stage of labour: a randomized controlled trial. *BJOG*. 2016;123:2199–2207.
132. Gustafson GW. Management of occiput posterior. *J Am Med Assoc*. 1949;139:280–285.
133. Haynes DM. Occiput posterior position: six years' experience at Parkland Memorial Hospital. *J Am Med Assoc*. 1954;156:494–496.
134. McKelvey JI, Diefenbach EJ. The obstetric significance of the posterior occiput position. *Postgrad Med*. 1951;9:211–214.
135. Spong CY, Berghella V, Wenstrom KD, Mercer BM, Saade GR. Preventing the first cesarean delivery: summary of a joint Eunice Kennedy Shriver

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national Institute of Child health and human development, society for maternal-fetal medicine, and American College of obstetricians and Gynecologists Workshop. *Obstet Gynecol*. 2012;120:1181—1193.
136. Le Ray C, Serres P, Schmitz T, Cabrol D, Goffinett F. Manual rotation in occiput posterior or transverse positions. *Obstet Gynecol*. 2007;110: 873—879.
137. Shaffer BL, Cheng YW, Vargas JE, Caughey AB. Manual rotation to reduce cesarean delivery in occiput posterior or transverse position. *J Matern Fetal Neonatal Med*. 2011;24:65—72.
138. Shaffer BL, Cheng YW, Vargas JE, Laros Jr RK, Caughey AB. Manual rotation of the fetal occiput: predictors of success and delivery. *Am J Obstet Gynecol*. 2006;194:e7—e9.
139. Le Ray C, Deneau-Tharaux C, Khireddine I, Dreyfus M, Vardon D, Goffinett F. Manual rotation to decrease operative delivery in posterior or transverse positions. *Obstet Gynecol*. 2013;122:634—640.
140. Reichman O, Gdansky E, Latinsky B, Labi S, Sameuloff A. Digital rotation from occipito-posterior to occipito-anterior decreases the need for cesarean section. *Eur J Obstet Gynecol Reprod Biol*. 2008;136:25—28.
141. Phipps H, Heyett JA, Kuah S, et al. Persistent occiput posterior position — OUTcomes following manual rotation (POP-OUT): study protocol for a randomized controlled trial. *Trials*. 2015;16:96.
142. Verhaeghe C, Parot-Schinkel E, Bouet PE, et al. *Trials*. 2018;19(1):109.
143. Barth Jr WH. Persistent occiput posterior. *Obstet Gynecol*. 2015;125: 695—709.
144. Hankins GD, Leicht T, Van Hook J, Uçkan E. The role of forceps rotation in maternal and fetal injury. *Am J Obstet Gynecol*. 1999;180:231—234.
145. Powell J, Gilo N, Foote M, Gil K, Lavin JP. Vacuum and forceps training in residency: experience and self-reported competency. *J Perinatol*. 2007;27:343—346.
146. Chinnock M, Robson S. An anonymous survey of registrar training in the use of Kielland's forceps in Australia. *Aust N Z J Obstet Gynaecol*. 2009;49:515—516.
147. Bahl R, Van de Venne M, Macleod M, Strachan B, Murphy DJ. Maternal and neonatal morbidity in relation to the instrument used for mid-cavity rotational operative vaginal delivery: a prospective cohort study. *BJOG*. 2013;120:1526—1532.
148. Burke N, Field K, Mujahid F, Morrison JJ. Use and safety of Kielland's forceps in current obstetric practice. *Obstet Gynecol*. 2012;120: 766—770.
149. Bradley MS, Kaminski RJ, Streitman DC, Dunn SL, Krans EE. Effect of rotations on perineal lacerations in forceps-assisted vaginal deliveries. *Obstet Gynecol*. 2013;122:132—137.
150. Stock SJ, Josephs K, Farquharson S, et al. Maternal and neonatal outcomes of successful Kielland's rotational forceps delivery. *Obstet Gynecol*. 2013;121:1032—1039.
151. Tempest N, Hart A, Walkinshaw S, Hapangama D. A reevaluation of the role of rotational forceps: retrospective comparison of maternal and perinatal outcomes following different methods of birth for malposition in the second stage of labour. *BJOG*. 2013;120:1277—1284.
152. Allen VM, O'Connell CM, Baskett TF. Maternal and perinatal morbidity of caesarean delivery at full cervical dilatation compared with caesarean delivery in the first stage of labour. *BJOG*. 2005;112:986—990.
153. Alexander JM, Leveno KJ, Rouse DJ, et al. Comparison of maternal and infant outcomes from primary cesarean delivery during the second compared with the first stage of labor. *Obstet Gynecol*. 2007;109:917—921.
154. de la Torre L, González-Quintero VH, Mayor-Lynn K, et al. Significance of accidental extensions in the lower uterine segment during cesarean delivery. *Am J Obstet Gynecol*. 2006;194:e4—e6.
155. Berhan Y, Berhan A. A meta-analysis of reverse breech extraction to deliver a deeply impacted head during cesarean delivery. *Int J Gynaecol Obstet*. 2014;124:99—105.

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