Persistent occiput posterior (OP) is associated with increased rates of maternal and newborn morbidity. Its diagnosis by physical examination is challenging but is improved with bedside ultrasonography. Occiput posterior discovered in the active phase or early second stage of labor usually resolves spontaneously. When it does not, prophylactic manual rotation may decrease persistent OP and its associated complications. When delivery is indicated for arrest of descent in the setting of persistent OP, a pragmatic approach is suggested. Suspected fetal macrosomia, a biparietal diameter above the pelvic inlet or a maternal pelvis with android features should prompt cesarean delivery. Nonrotational operative vaginal delivery is appropriate when the maternal pelvis has a narrow anterior segment but ample room posteriorly, like with anthropoid features. When all other conditions are met and the fetal head arrests in an OP position in a patient with gynecoid pelvic features and ample room anteriorly, options include cesarean delivery, nonrotational operative vaginal delivery, and rotational procedures, either manual or with the use of rotational forceps. Recent literature suggests that maternal and fetal outcomes with rotational forceps are better than those reported in older series. Although not without significant challenges, a role remains for teaching and practicing selected rotational forceps operations in contemporary obstetrics.

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There are levels of the game to every game, as presumptuous hobbyists learn to their sorrow. At one time in my life, I fancied myself pretty good—O.K., maybe even a little better than pretty good—at doing crossword puzzles. Then I met Stanley Newman.


I trained in an era and at an institution with faculty who taught operative vaginal delivery including Kieland rotations. By the time I finished residency, I had accumulated a fair experience with forceps, including rotational forceps. I thought I was pretty good, and better than most in the management of persistent occiput posterior (OP). Then, I met Lenny Safon.

Dr. Leonard Safon, a Boston obstetrician then in his mid 60s, seemed to live on Labor and Delivery, often staying late into the night to deliver his patients even when not on call. He won our teaching award so many times that it was eventually named for him. Late one night, we began a discussion about persistent OP, and it became obvious to me that I was an amateur, or worse, an overconfident amateur. Lenny used terms and concepts that I had memorized only for in-service examinations. I was certainly not applying them as knowledgeably to my practice. Sensing this, Lenny made a generous offer and for the next 2 years, he would page me to come to Labor and Delivery if available for what became an unofficial apprenticeship in the management of persistent OP.

Despite this kind of experience and the continuous practice of obstetrics for 25 years since that time, there remains a phone call that still provokes in me an immediate and visceral anxiety: “Hi, Bill. Mrs. Jones, who you have not met, has been pushing for 3-1/2 hours and we think the fetus may be OP. Can you come to labor and delivery?” Experiencing some degree of anxiety with this call is not logical. Why,
after my training and experience, does this still cause concern? Often the patient is exhausted. The nurses are commonly frustrated. The patient’s family is concerned, and some may be angry. In a short period of time I must gain the patient’s confidence and trust. I have to review a now abnormal labor course, evaluate the patient and her fetus clinically, counsel her about the nuanced risks and benefits of cesarean compared with vaginal delivery, and, if recommending the latter, recruit the support of the nurses and other health care providers and prepare for and perform an operative vaginal delivery without harming the mother or the fetus. I profess no greater or lesser skill with forceps, including rotational forceps, than any of my contemporaries. Accordingly, this communication is not about the broader topic of operative vaginal delivery covered by Yeomans’ earlier in this series. Rather, I focus on the problem of persistent OP and offer an approach that is appropriate for contemporary practice. It is centered on Dr. Safon’s most important admonition to me: “Bill, not all OPs are the same.”

DEFINITION
Persistent OP is when the occiput remains in the posterior quadrants of the pelvis until delivery, whether that delivery is spontaneous or indicated for a nonreassuring fetal status or arrest of descent in the second stage.

INCIDENCE
The incidence of persistent OP ranges from 5–12%. Right OP is the most common (60%) followed by left OP (30%) and direct OP (10%). Occiput posterior is twice as common among nulliparous women as multiparous women. Importantly, the incidence of OP varies depending on the time of ascertainment in labor. Authors relying on ultrasonograms to assess fetal head position throughout labor report that approximately 50% of fetuses engage or begin labor in the occiput transverse position with the remainder divided equally between occiput anterior (OA) and OP. Among those beginning labor in the OP position, most (80–90%) will rotate to OA before spontaneous or assisted delivery. Spontaneous rotation to OA is often a late phenomenon and may not occur until well into the second stage of labor. Although OP discovered late in labor is more likely to persist, 50–80% of those beginning the second stage in an OP position will still rotate spontaneously to OA before delivery. Malrotation from OA to OP is rare (less than 5%) once the second stage has begun.

ETIOLOGY
Factors that may influence the risk of persistent OP include the shape of the pelvis, epidural analgesia, parity, race, and others. For decades, standard teaching in obstetrics suggested that features of the female bony pelvis were a major determinant of engagement and descent of the fetal head during labor. Given the typical shape of the fetal head, it was assumed that at each level of the pelvis, there was an optimal position for the fetal head to pass and that, as a general rule, the larger fetal occiput tended to rotate to that portion of the pelvis with the most room. The shape of the pelvis does have some influence on the final position at the time of delivery. This is supported by studies showing a tendency for OP to recur in subsequent pregnancies and radiographic studies showing a higher rate of OP among women with features of an anthropoid pelvis. There are racial differences in pelvic architecture. Handa and colleagues studied patients with and without anal sphincter tears from the Childbirth and Pelvic Symptoms Study (CAPS) with magnetic resonance imaging. Confirming earlier studies, these authors demonstrated that white women had wider pelvic inlets and outlets, whereas African American women had deeper anteroposterior outlets. This may partially explain the increased prevalence of persistent OP seen among African American women in recent observational studies.

The relationship between the use of epidural analgesia and persistent OP is complex. The association between epidural analgesia and an increased rate of persistent OP at the time of delivery seen in retrospective cohort studies has not been confirmed in randomized trials. A meta-analysis of four such trials demonstrated no difference in the rate of malposition at the time of delivery among women who were randomized to epidural analgesia compared with those randomized to other methods or no analgesia (relative risk 1.40, 95% confidence interval [CI] 0.98–1.99). If the mechanism by which epidurals are thought to increase the risk of persistent OP is by causing a more relaxed and accommodating levator complex, we should see more persistent OP among multiparous women and that is not the case. Observational studies consistently show that persistent OP is more common among nulliparous than multiparous women by a factor of more than two to one. Large retrospective cohort studies suggest that other factors such as race, nulliparity, body mass index (calculated as weight (kg)/[height (m)]^2) higher than 30, macrosomia, maternal age older than 35 years, augmentation of labor, and anterior placental...
location may also contribute to persistent OP, but none of these, either singly or together, reliably predict persistent OP.\textsuperscript{18,21,22}

**MATERNAL MORBIDITY**

Occiput posterior is associated with higher rates of dystocia, cesarean delivery, operative vaginal delivery, failed operative vaginal delivery, and severe perineal lacerations (third and fourth degree). Large retrospective cohort studies consistently demonstrate that OP is associated with longer first and second stages of labor, prolonged labor, and the need for augmentation.\textsuperscript{4,9,21} Senécal and colleagues\textsuperscript{24} demonstrated that the second stage of labor was approximately 45 minutes longer if the fetus was OP compared with OA at the onset of the second stage whether pushing started immediately or was delayed. The likelihood of cesarean delivery increases the later in labor that OP is noted. It is not associated with an increased risk of cesarean delivery when noted before labor, is associated only weakly in early labor, and becomes strongly associated with cesarean delivery if persisting into the second stage.\textsuperscript{5,24,25} When persisting to the point at which delivery is indicated, OP is associated with a 4- to 10-fold increase in the risk of cesarean delivery with absolute rates as high as 65%.\textsuperscript{4,6,22} Occiput posterior is associated with a 6- to 11-fold increase in the need for operative vaginal delivery\textsuperscript{26–28} and a 5- to 10-fold increase in the rate of failed operative vaginal delivery.\textsuperscript{21,29}

Vaginal delivery from OA is most often associated with a well-flexed fetal head causing the suboccipitobregmatic diameter (approximately 9.5 cm) to pass through the outlet and over the perineal body (Fig. 1). Occiput posterior positions are associated with more extended attitudes of the fetal head, probably as a result of forward impingement of the maternal sacral promontory on the fetal spine and resulting extension of the neck. With extended attitudes, the diameter that must pass through the outlet is somewhere between the occipitofrontal (approximately 11.5 cm) and the occipitomental (approximately 13.5 cm) (Fig. 1). As such, it is no surprise that OP is associated with substantially higher rates of third- and fourth-degree perineal lacerations.\textsuperscript{4,9,30} Adjusting for episiotomy, forceps, vacuum, and other factors, Cheng and colleagues\textsuperscript{21} reported that delivery in the OP position doubled the risk of third- or fourth-degree extension (relative risk 2.4, 95% CI 2.0–2.8). Modern cohort studies report absolute rates of third- and fourth-degree extensions with operative vaginal delivery from OP ranging from 33% with a vacuum to as high as 50–70% with forceps.\textsuperscript{30,28} In a recent case–control study from the National Institute of Child Health and Human Development and the Pelvic Floor Disorders Network, Fitzgerald and colleagues reported odds ratios (ORs) for sphincter injury with OP, forceps, or the two combined of 7.0, 13.6, and 21.6, respectively. Vacuum deliveries from OP were associated with an OR of 9.7.\textsuperscript{31} The highest risk resulted from the combination of OP, forceps, and episiotomy (OR 33.8, 95% CI 4.8–239.5).

Cesarean delivery in the second stage of labor, especially if the second stage is prolonged, is associated with higher risks of bleeding and surgical injury, such as inadvertent extension of the hysterotomy into the cervix, vagina, uterine artery, and broad ligament.\textsuperscript{32–37} At least one study has demonstrated a doubling of the risk of such extensions when the occiput is posterior.\textsuperscript{34}

**NEWBORN OUTCOMES**

Older studies reported more abnormal fetal heart patterns with persistent OP including more variable and late decelerations and more bradycardia.\textsuperscript{38–40} There are no contemporary studies examining intrapartum fetal heart rate patterns with persistent OP relying on the newer National Institute of Child Health and Human Development classification system. The neonatal morbidity associated with OP occurs primarily among those who require operative vaginal delivery and does not extend to those delivered spontaneously.\textsuperscript{30,41} Cheng and colleagues\textsuperscript{41} compared the outcomes of 2,591 newborns delivered from...
OP to 28,801 delivered from OA. Newborns delivered from OP had higher rates of low Apgar scores (OR 1.5, 95% CI 1.17–1.91), cord gas acidemia (OR 2.05, 95% CI 1.52–2.77), meconium (OR 1.29, 95% CI 1.17–1.42), birth trauma (OR 1.77, 95% CI 1.22–2.57), and neonatal intensive care unit admission (OR 1.57, 95% CI 1.28–1.92). When the authors adjusted for other factors that influence newborn outcome and stratified patients by mode of delivery, almost all of these associations weakened or disappeared. The only outcome associated with OP that remained significant with an OR exceeding 2 was birth trauma among those with operative vaginal delivery.

**DIAGNOSIS**

The determination of fetal head position is typically made by physical examination. Unfortunately, such examinations are notoriously inaccurate before full dilation of the cervix. The accuracy of physical examination improves as labor progresses into the second stage, but not as much as one might think. Among five contemporary prospective cohort studies comparing the accuracy of digital vaginal examination with that of ultrasonography for determination of position in the second stage, the rate of errors exceeding 45° ranged from 30–80%. In some studies, almost half of the physical examinations that were wrong were off by more 135°. Clinicians are able to determine OA positions more accurately (80–85%) than OP positions (50–60%). Factors such as station, molding, caput, and experience of the examiner do not dramatically affect the accuracy of physical examination.

Most studies that use ultrasonography to determine fetal head position show it to be highly reproducible in experienced hands. These examinations are typically performed with a portable ultrasound system with a transducer held in the transverse position just above the symphysis pubis. Determining position of the fetal occiput depends on demonstrating the position of the fetal orbits, the falx, and the fetal spine (Fig. 2). Although ultrasonography can be more accurate than digital vaginal examination in the second stage of labor, I do not believe it is essential before all operative vaginal deliveries. However, when the physical examination is not clear, more liberal use of ultrasonography before rotation has the potential to improve the safety of such deliveries in contemporary practice.

**MANAGEMENT**

For purposes of this communication, I consider the management of OP as it may be encountered in contemporary practice: 1) before the onset of labor; 2) during active labor before full dilation; 3) early in the second stage; and finally, 4) once delivery is indicated for arrest of descent or nonreassuring fetal status in the second stage. Interventions that have been described for the first three are intended to prevent persistent OP and include maternal positioning and prophylactic manual rotation. When additional waiting is no longer an option, interventions in the last scenario

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**Fig. 2.** Transabdominal ultrasound determination of the fetal occiput. Direct occiput posterior with both fetal orbits facing the transducer (A), right occiput posterior with the fetal orbits facing anteriorly to the maternal left (B), right occiput anterior with the fetal cerebellum seen anteriorly to the maternal right (C), and occiput anterior by localization of the fetal spine in the sagittal plane (D).

include cesarean delivery and operative vaginal delivery with or without rotation. For this last situation, I propose an ordered approach that I have found helpful when called to assist in the second stage in the setting of persistent OP.

**Before the Onset of Labor**

If asked to consult before labor, I would not alter recommendations for standard obstetric management. First, the majority of fetuses will rotate to an anterior position during labor, even late in labor. Occiput posterior before labor predicts neither an increased risk of cesarean delivery nor the final position at the time of delivery. Second, there are no interventions before labor that are effective in decreasing persistent OP. Karimina and colleagues randomized 2,500 women with singleton pregnancies to hands and knees position with pelvic rocking from 37 weeks of gestation until delivery. The rate of persistent OP in the treatment group (105/1,298 [8.1%]) was no different than that in the control group (98/1,255 [7.8%]).

**During the First Stage of Labor**

If consulted about an OP position in the first stage of labor, my response is similar. At most, such information might heighten my vigilance regarding fetal position in the second stage, but there is no evidence to support maternal positioning to encourage rotation of the occiput in the active phase. Stremler and colleagues randomized 147 women with ultrasonography-confirmed OP positions in labor to as much time as possible in the knee–chest position or to a control group instructed to assume any position other than knee–chest. Women in the treatment group had no significant increase in the proportion that was OA 1 hour after the intervention or at delivery. In another clinical trial, Desbriere and colleagues randomized women in active labor confirmed by ultrasonography to be in the OP position to either a dorsal recumbent position or to purposeful maternal positioning that was intended to encourage rotation. The authors noted no differences in any important clinical outcomes, including fetal head position at delivery, duration of the first or second stage of labor, length of pushing, rates of operative vaginal delivery, cesarean delivery, or perineal tears. Consequently, if consulted for arrest of dilation or a protraction disorder associated with OP before full dilation, I would recommend standard management with oxytocin unless otherwise contraindicated and I would move to cesarean delivery if this did not solve the problem. Importantly, I would avoid and recommend against any attempt to rotate the fetal head before full dilation of the cervix. Before full dilation, the failure rate of manual rotation is high, and at least one group has reported cord prolapse, cervical lacerations, and nonreassuring fetal heart rate patterns with such attempts.

**Early in the Second Stage**

If the fetal status is reassuring and labor is progressing, there is no immediate need to intervene for OP at the beginning of the second stage. In this setting, conservative management without intervention has been advocated for decades. Because spontaneous rotation to OA is so common, if performed too early, any manual rotations or complications arising from them are likely to have been unnecessary. The dilemma arises as OP persists longer into the second stage. As it does, the probability of spontaneous rotation decreases and the likelihood of adverse outcomes associated with delivery from OP increases (cesarean delivery, operative vaginal delivery, maternal perineal lacerations, and fetal effects of operative vaginal delivery). Compounding this dynamic, manual rotation is more likely to be successful if performed early than if it is attempted once an arrest of labor has occurred.

In light of this, recent authors have advocated “prophylactic manual rotation” earlier in the second stage as a means of preventing persistent OP. Retrospective cohort studies demonstrate significantly lower rates of cesarean delivery when manual rotations are successful and high rates of success when it is attempted. In the only prospective study to date, Reichman and colleagues enrolled women with a fetus in the OP position halfway into the second stage (1 hour for nulliparous women, 30 minutes for multiparous women, +30 minutes if laboring with an epidural). Compared with the expectant management group, those who underwent prophylactic rotation were more commonly OA at delivery (93% compared with 15%, \(P<.001\)), more likely to have a spontaneous vaginal delivery (77% compared with 27%, \(P<.001\)), and less likely to require operative vaginal delivery (23% compared with 50%, \(P<.001\)) or cesarean delivery (0 compared with 23%, \(P<.001\)). Although none of these studies are without limitations, this approach appears to have few downsides for the mother or fetus. The only adverse maternal outcome of note in these reports is the possibility of a slight increase in the risk of cervical lacerations but with an absolute risk that remains low (approximately 2%). Newborn outcomes are generally the same or better among those undergoing manual rotation. The risk of emergency cesarean delivery for an abnormal fetal heart rate tracing precipitated by a prophylactic manual rotation is approximately 1%. Given the low risks of prophylactic manual rotation and the potential...
for significant reductions in cesarean delivery and other adverse outcomes associated with delivery from OP, my current practice is to wait for some period of time—approximately 1 hour for nulliparous women and 30 minutes for multiparous women, possibly longer with an epidural—and then evaluate the patient for a prophylactic manual or digital rotation. If my pelvic examination suggests crowding in the anterior segment and ample room posterior, like with an anthropoid pelvis, OP may be the most optimal position, and I do not attempt a prophylactic manual rotation.

**Technique for Manual or Digital Rotation**

Numerous variations of manual and digital rotation of the fetal occiput have been described previously. The main difference between the two is that with manual rotations, the whole hand is placed in the vagina to grasp the fetal head, whereas with digital rotations, only two fingers are inserted to apply rotational force. For manual rotations from left OP, the operator’s right hand is placed in the vagina palm up with four fingers spread evenly across the left side of the fetal head from occiput to chin with the thumb gently held across the opposite side (Fig. 3A). The fetal head is slightly destationed, flexed, and rotated counterclockwise to left OA or OA by pronation of the operator’s right hand. The operator’s left hand can be used to reach across the maternal abdomen and pull the right fetal shoulder from the maternal left to right side concurrent with the rotation. For manual rotations from right OP, the hands and directions are exactly reversed. The operator’s left hand is placed in the vagina, palm up, with four fingers spread across the right side of the fetal head and the thumb gently held across the opposite side. Again, the fetal head is slightly elevated, flexed, and rotated clockwise to a right OA position. Although guidance varies in prior reports, I have found manual rotations more easily accomplished between contractions and in those patients with an epidural in place. I have also found that breaking down the labor bed and placing the patient in a dorsal lithotomy position with the hips flexed and legs supported before the attempt allows me to complete the rotation more easily as my elbow drops toward the floor and below the patient’s buttocks as I complete pronation while maintaining flexion of the fetal head. I generally withdraw my thumb and keep my four fingers in position, applying gentle pressure until the head settles into position, sometimes immediately, sometimes only with the next contraction. Digital rotations are similar, but with only two fingers inserted into the vagina to find and hold the posterior edge of the upper parietal bone near the junction of the lambdoid suture and posterior fontanel (Fig. 3B). With either type of rotation, if gentle force does not affect rotation, there are only two maneuvers to consider before abandoning the attempt, flexing the head more or elevating slightly to a higher station. Flexing the fetal head will decrease the diameter that must be rotated, and elevating may find a more favorable level of the pelvis to allow rotation, especially if molding has taken place. The two techniques, manual and

**Fig. 3.** 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 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. A is reprinted and B is modified from Hale RW, editor. Posterior presentations of the occiput. In: American College of Obstetricians and Gynecologists. Dennen’s forceps deliveries. 4th ed. Washington, DC: American College of Obstetricians and Gynecologists; 2001.
digital rotation, have not been compared with each other with regard to ease, safety, or efficacy, but there are some important differences. First, manual rotations tend to be more uncomfortable for the patient, because the operator’s whole hand is inserted and rotated within the vagina along with the fetal head. Second, because the head must generally be elevated slightly more to place the fingers correctly around the fetal head with manual rotation, care must be taken not to disengage the head because cord prolapse is possible with the rush of amniotic fluid that often accompanies this maneuver. Finally, the ultimate choice may be health care provider-dependent. Because my hands are larger, I generally prefer to attempt a digital rotation first, especially if the rotation is performed prophylactically to prevent persistent OP.

**Persistent Occiput Posterior With Arrest of Descent or Nonreassuring Fetal Status**

This, by far, is the most challenging situation for the clinician, especially if called on to consult or assume care for the patient late in the course of labor once persistent OP has become a problem that must be addressed. In this situation, I believe there are five critical questions that must be answered to guide the method of delivery (Box 1).

**Is Delivery Indicated at This Time?**

Because OP is associated with longer second stages, it is especially important to distinguish between a prolonged second stage and arrest of descent. Since 1988, the American College of Obstetricians and Gynecologists has defined a prolonged second stage as greater than 2 hours for nulliparous women and greater than 1 hour for multiparous women unless an epidural is in place, in which case these times are 3 hours and 2 hours, respectively. An arrest of descent need not coincide with these times and occurs when there has been no descent of the fetal vertex in 1 hour despite adequate maternal expulsive efforts. If the fetal status is reassuring, maternal efforts are strong, and progress in descent is being made, an additional amount of time to allow spontaneous vaginal delivery of the persistent OP may be perfectly appropriate. On the other hand, if arrest of descent has occurred in the OP position despite adequate maternal efforts, it is unlikely that additional time without intervention will be successful and some form of operative intervention is indicated, whether abdominal or vaginal. Typically, if consulted for arrest of descent in the second stage with persistent OP, my experience is that the patient will usually have been pushing beyond the typical definitions of a prolonged second stage and intervention is almost invariably warranted.

**Is Vaginal Delivery Contraindicated?**

There are three contraindications to operative vaginal delivery that are especially important in arrest of descent with persistent OP. These are suspected fetal macrosomia, a high station, or a pelvis with marked android features, raising the possibility of dangerous outlet obstruction. To avoid these pitfalls when called to consult for a patient I have not previously seen, I have found it helpful to follow a standard approach (Fig. 4). I begin by confirming or ascertaining the estimated fetal weight by reviewing any recent ultrasound reports and performing Leopold’s maneuvers myself. If macrosomia is suspected, operative vaginal delivery for arrest of descent in the second stage is contraindicated whether the fetus is OP or not. The second contraindication is more unique to persistent OP. For decades, authors have warned of the occurrence of extreme molding and caput formation with persistent OP such that the biparietal diameter may remain deceptively higher than suspected with vaginal examination. Indeed, with persistent OP and a prolonged second stage, the biparietal diameter may be above the ischial spines and possibly still near the inlet, although the scalp may be visible at the vaginal introitus. Therefore, if I can palpate the biparietal diameter abdominally with Leopold’s third or fourth maneuvers (Fig. 5A and B) in the setting of an arrest of descent in the OP position, I know the station is high and delivery must be by cesarean, even if the scalp is visible on the perineum.

In the absence of suspected macrosomia and provided I do not feel the biparietal diameter abdominally, I move on to a careful pelvic examination with attention to the fetal position and specific features of the maternal bony pelvis. Like many obstetricians, I memorized the Caldwell Moloy pelvic types as a resident, primarily for test-taking purposes. However, it is in this setting that an understanding of the pelvic types and their features remains extremely helpful. In my opinion, the third contraindication to

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**Box 1. Questions That Must Be Answered to Guide the Method of Delivery for Persistent Occiput Posterior**

1. Is delivery indicated at this time?
2. Is vaginal delivery contraindicated?
3. What is the true position of the fetal head?
4. Should rotation be considered before vaginal delivery?
5. If rotating, which method is preferred?
proceeding with operative vaginal delivery in the setting of persistent OP is a pelvis with marked android features, suggesting the possibility of a dangerous outlet obstruction described even by the earliest writers in this area.\textsuperscript{12,58} This occurs as a result of the narrow or crowded anterior segment forcing the vertex posterior combined with the forward sacrum and short posterior segment producing the potentially dangerous bony obstruction. With this in mind, I continue with the maneuvers shown in Figure 5. If android features are noted at this point (narrow subpubic arch, narrow retropubic angle, a short sacrospinous ligament, or palpably forward lower third of the sacrum) in the setting of arrest of descent with persistent OP (and OA in my own practice), cesarean delivery is indicated to avoid the potential for fetal and maternal morbidity. If, on the other hand, I do not get the sense of android features, I proceed to the next step.

**What is the True Position of the Fetal Head?**
Concurrent with the careful examination of the pelvis, I try to confirm OP by palpation of the anterior fontanel, sometimes aided by palpation of an ear if possible. If I have any doubt at all, I rely on ultrasonography to confirm the position of the occiput. For direct OP positions, I have also found that ultrasound detection of the fetal spine helps me in determining the proper direction of rotation. Although unusual, the direction of the fetal occiput and spine at the level of the thorax is not always concordant (Fig. 6) and suggests to this author that rotation in what appears to be the short arc is not always the correct route.

**If Vaginal Delivery Is Not Contraindicated, Should Rotation Be Considered?**
If on pelvic examination the anterior segment is crowded (narrow retropubic angle and subpubic arch), but there is ample room in the posterior segment typical of an anthropoid pelvis, there is no benefit to rotating the larger fetal occiput into a narrow or crowded anterior segment. Indeed, anterior rotation of the larger occiput in the setting of an acute subpubic arch with longer inferior pubic rami and a narrow transverse outlet will necessarily force the vertex posterior and increase risk to the perineum and rectal sphincter muscles. In this setting, I would recommend an operative vaginal delivery from OP without rotation. Because forceps fail less often than vacuum in the setting of persistent OP, I prefer them. Also, because arrest of descent with persistent OP is invariably
associated with significant molding, I prefer Simpson forceps because of the shallower and longer cephalic curve. Elliot-style forceps with their more rounded cephalic curve are not recommended in this setting because they tend to apply pressure at the heel and toe of the blades. I generally use a Bill’s axis of traction bar to help identify the correct line of traction, which may be difficult to find with what is often a higher station than anticipated and the need to continue downward traction until the brow clears the symphysis pubis before flexion should begin. Finally, because of the high rate of sphincter injury with the combination of OP and a forceps delivery, in this setting only, I perform a mediolateral episiotomy near completion of the delivery and remove the forceps before complete expulsion to protect the external anal sphincter. Although uncommon in the United States, recent cohort studies from The Netherlands demonstrate profound reductions in rectal sphincter injury with mediolateral episiotomy in the setting of forceps-assisted vaginal delivery. For a review of the performance and repair of mediolateral episiotomy, readers are referred to the illustrated manual published by the American College of Obstetricians and Gynecologists.

Should Rotation to Occiput Anterior and Operative Vaginal Delivery Be Performed?

From a purely pragmatic perspective, if delivery is indicated for a category 3 fetal heart rate tracing in the setting of persistent OP, the decision is usually

Fig. 5. Physical examination of the pelvis to aid decision-making with arrest of descent in the second stage with persistent occiput posterior. Step 1: Leopold’s third (A) and fourth (B) maneuvers to determine whether the biparietal diameter can be palpated abdominally. Step 2: Examination of the retropubic angle (C) and pubic arch (D) to assess capacity of the anterior segment of the pelvis from inlet to outlet, respectively. Step 3: The relative capacity of the posterior segment is aided by palpating the length of the sacrospinous ligament (E). A short ligament (F) suggests a crowded posterior segment with prominent spines and a forward sacrum and coccyx. This finding raises the possibility of a dangerous outlet obstruction and is an indication for cesarean delivery in the setting of an arrest of descent with persistent occiput posterior.


Fig. 6. Ultrasonogram showing discordant positions of the fetal spine. A. The fetal spine to the maternal right. B. The fetal orbits also directed anterior to the maternal right, implying a left occiput posterior position.

whether to proceed with emergent cesarean delivery or an operative vaginal delivery, either with forceps or vacuum, without rotation. One of the faculty physicians who taught me how to perform Kielland rotations (Gary D. V. Hankins) has suggested that because a successful rotation cannot be guaranteed and because a cesarean delivery can usually be performed just as quickly, the latter is generally preferred.\textsuperscript{74} If operative vaginal delivery is considered in this setting, I would choose forceps over a vacuum, again because they are less likely to fail.\textsuperscript{75}

In the setting of an arrest of descent with persistent OP with a more reassuring fetal heart rate tracing (category 1 or 2), if my clinical evaluation of the pelvis suggests an ample anterior segment like with a gynecoid pelvis, and assuming that the other requirements of operative vaginal delivery are met, my usual recommendation is for a trial of rotation, with or without forceps, followed immediately by forceps-assisted vaginal delivery. Although it is less likely to be successful in the setting of arrest of descent, I usually begin with an attempt at manual or digital rotation (usually in the labor room) as previously described, because there are no reports of fetal injuries associated with such attempts. If this rotation is successful, asking the patient to push for a few contractions to determine if spontaneous delivery is imminent is an option, but in the setting of an already prolonged second stage, I usually proceed with traction forceps (Simpsons) to complete the delivery.

If the manual or digital rotation is unsuccessful, the remaining options include cesarean delivery, forceps or vacuum delivery without rotation, rotational vacuum, and finally, rotational forceps followed by nonrotational forceps. My own preference is to counsel the patient about the relative risks and benefits of a trial of rotational forceps compared with a cesarean delivery or nonrotational forceps for arrest of descent with persistent OP in the second stage, in that order. Although there are advocates of rotational or nonrotational vacuum for persistent OP, I have less confidence in these procedures once the fetal head is molded and impacted deep in the pelvis in the OP position. The failure rate of nonrotational vacuum from OP is high\textsuperscript{29} and the only correction that can be imparted with rotational vacuum is to improve flexion of the fetal head and hope that autorotation occurs with traction and descent. Torque on a vacuum extractor to effect rotation is contraindicated as a result of the risk of scalp lacerations and more serious injuries. In their guidelines for operative vaginal delivery, at least one professional organization lists the need for rotation of more than 45° as a relative contraindication to vacuum delivery.\textsuperscript{67}

Although there are a few randomized clinical trials comparing forceps with vacuum for operative vaginal delivery, there are no such trials comparing rotational forceps for persistent OP with the alternatives and such trials are unlikely to be forthcoming. Furthermore, almost all cohort studies comparing these options are inevitably confounded by indication. Nonetheless, there are some common themes regarding one approach compared with another.

**Rotational Forceps Deliveries**

The relative risks, benefits, and safety of rotational forceps deliveries have been debated for decades. Those suggesting that such procedures should be abandoned usually cite one of three reasons: 1) an unacceptably high rate of serious fetal morbidity such as skull fracture, tentorial tears, intracranial hemorrhage, or spinal cord injury; 2) a growing lack of experienced health care providers willing to perform and teach the procedure; and finally 3) an insufficient volume to maintain competence.

Concern for higher rates of fetal injury stems from older case series and retrospective cohort studies.\textsuperscript{76–81} Newer cohort studies demonstrate more favorable fetal outcomes, fewer maternal third- and fourth-degree lacerations, and avoidance of the complications associated with cesarean delivery in the second stage.\textsuperscript{74,75,83–89} Burke and colleagues\textsuperscript{85} prospectively collected data on all attempted Kielland forceps deliveries from 1997 to 2011 at Galway University Hospital in Ireland. The authors described 144 attempted Kielland rotational forceps operations, 129 (90\%) of which were successful. The authors reported no cases of neonatal trauma among the 129 successful procedures and only one third- or fourth-degree tear. Bahl and colleagues\textsuperscript{75} report a success rate higher than 90\% (355/381) and few instances of neonatal morbidity among 381 midcavity rotational operative vaginal deliveries largely performed by residents under the supervision of the faculty at two university hospitals in the United Kingdom. This group demonstrated similar maternal and fetal outcomes among three planned approaches: manual rotation followed by nonrotational forceps, rotational vacuum, and Kielland rotations followed by forceps. However, the failure rate of the primary method requiring a second instrument was much higher with planned vacuum rotation (36.9\%) when compared with manual (1\%) or Kielland (0\%) rotations. Bradley and colleagues\textsuperscript{87} compared the maternal and fetal outcomes of 91 rotational operative vaginal deliveries (31 forceps rotations, 60 manual rotations...
followed by forceps] with 57 nonrotational forceps with delivery in the OP position. Similar to other studies, maternal and newborn outcomes were similar, but delivering with forceps in the OP position without rotation was associated with a significantly increased risk of third- or fourth-degree laceration (43% compared with 24%, adjusted OR 3.67, 95% CI 1.42–9.47). In a large cohort study, Stock and colleagues described the maternal and newborn outcomes associated with 873 successful Kielland rotations between 1995 and 2008 in a single institution where such procedures are still practiced and taught. Neonatal complications were rare, including admission to the neonatal intensive care unit (4.7%), Apgar score less than 7 at 5 minutes (3.8%), cephalohematoma (1.4%), transient nerve palsy (1.5%), permanent nerve palsy (0%), and subdural hematoma (0.1%). In this study, the rate of hemorrhage greater than 1 L was three times higher with cesarean delivery than with a successful Kielland rotational delivery. Finally, Tempest and colleagues compared the maternal and newborn outcomes of 1,038 Kielland rotational forceps with 107 vacuum-assisted deliveries and 146 second-stage cesarean deliveries. Improving on prior cohort studies by relying on an intention-to-treat analysis and adjusting for indication for delivery and experience of the operator, these authors noted no differences in the rates of maternal hemorrhage or neonatal admission to a special care unit. Importantly, not a single case of spinal cord injury was reported in these five contemporary series described (0/2,966 [0%]; 95% CI 0.0–0.16%). Although I mention this complication when counseling patients, I stress that it is extraordinarily rare and is probably associated only with ill-advised persistence through a difficult procedure, which I will not do. In light of such favorable neonatal outcomes and with an awareness that cesarean delivery late in the second stage with arrest of descent in the OP position can be a morbid procedure for the mother, it is this author’s opinion that rotational forceps should remain an option in contemporary obstetrics.

If rotational forceps operations are to continue, the procedure must be taught during residency and fellowship. In programs that have abandoned rotational forceps and no longer have faculty members willing to perform or teach rotations, this is an insurmountable challenge. In teaching programs that do have faculty trained in rotational forceps, clinicians not comfortable with the procedure must be willing to consult in the setting of an arrest of descent in the OP position. Similarly, those who are consulted must make themselves available if at all possible, a task that may require creative plans for coverage when assigned to duties away from the labor floor. Illustrating the importance of such supervision, among the 36 deaths resulting from intracranial injury reported by O’Mahoney in the Confidential Enquiries into Stillbirths and Deaths in Infancy, only two were performed or supervised by attending physicians.

That there are too few procedures to train residents and fellows, and too few to maintain competence, is an unfortunate self-perpetuating dynamic. At present, many graduating residents are not comfortable with forceps operations of any type, much less Kielland rotations. With the rate of operative delivery in many hospitals now less than 5%, I would argue that such training should be selective and that there is no point in diluting the experience of some by training those who will never practice rotational forceps. Next, although there is no substitute for the experience gained by the feel and real-time feedback in performing rotational forceps under supervision, a rational argument can be made for simulation training with realistic pelvic models before real-time application in hopes of gaining more when the rare occasion does arise.

**Conduct of Kielland Rotational Delivery**

With a gynecoid pelvis and no contraindication to vaginal delivery, if the patient is willing to attempt such a delivery, I move the patient to the operating room. In my hands, such deliveries are always a trial of rotational forceps. After informed consent, I generally write a preoperative note explaining my rationale and the critical components of the decision-making and recommendation as noted in Figure 4. With adequate anesthesia, I position the patient in the dorsal lithotomy position with the buttocks slightly overhanging the end of the bed, and I take care to make sure the hips are flexed only slightly such that the knees are approximately 30° off of the vertical and toward me. If I have not done so previously, I rely on ultrasonography to ensure that the occiput and spine are concurrent and that my attempted rotation is in the correct direction. After emptying the bladder and lubricating the Kiellands and, if successful, replace them with Simpson-type forceps for traction and delivery. After checking the position, I correct for any asynclitism by comparing the correspondent length of the handles and using the sliding lock to assure that the knobs are closely related. Next, I hold the handles in...
my right hand and use my left hand fingers to follow the rotation. Then, when the patient is not contract-
ing, I slightly elevate and flex the fetal head, then apply gentle rotational force in the direction moving the fetal spine in the short arc from posterior to ante-
rior (left OP to left OA, right OP to right OA). If I meet with resistance, the only two maneuvers are to elevate the head to a more favorable plane or to flex the head to achieve a more favorable diameter. Flex-
ing the head may require a slight adjustment of the forceps to a more occipitally oriented position. Addi-
tional rotational force is to be avoided. If the rotation is successful, often heralded by a sucking sound as the fetal head disengages and easily rotates, I gently reseat the head with the Kiellands. At this point I remove one blade and replace it with the corre-
sponding side of a pair of Simpson forceps to hold the position. After removing the other Kielland, I place the remaining Simpson blade and complete the delivery, this time without an episiotomy.

**Cesarean Delivery for Arrest of Descent With Occiput Posterior**

As described earlier, cesarean delivery in the second stage is a more morbid procedure for the mother than cesarean delivery before labor or during the active phase and this is especially so with OP. The fetal vertex is often deeply impacted and difficult to extract. Several authors have proposed techniques to facilitate delivery and minimize inadvertent hystere-
tomy extensions in this situation by elevating the fetal vertex with a vaginal hand (pushing from below), by reverse breech delivery (pulling from above as a breech), or by using various devices or specialized forceps to assist with disengagement of the fetal head. A recent meta-analysis of six pro-
spective and four retrospective studies comparing the push with the pull method found that pushing from below was associated with a significant increase in the risk of hysterotomy extension (OR 7.8, 95% CI 5.01–12.25), more infectious morbidity for the mother, and more blood transfusions but fewer fetal birth injuries.92 My own approach is to try to deliver the head in a standard fashion with my abdominal hand while trying not to back my wrist as a fulcrum into the lower uterine segment toward the cervix. If that is unsuccessful, and until further research settles the issue comparing outcomes between the push and pull methods for a deeply impacted fetal head, I usually ask for assistance with a hand from below and, then, if still unsuccessful, proceed with delivery of the feet and complete the delivery as a breech extrac-
tion from above.

**CONCLUSIONS**

Persistent OP need not be the bête noir of intrapartum obstetrics some believe it to be. When encountered in early labor, OP positions usually resolve spontaneously and a conservative approach is best. On the other hand, if rotation has not occurred after some period of observation in the second stage, more liberal use of prophylactic manual rotation may decrease maternal morbidity by preventing both cesarean deliveries and vaginal deliveries in the OP position. Once an arrest of descent has occurred in the second stage, an apprecia-
tion that not all OPs are the same is paramount in determining the safest route of delivery. Some should be delivered abdominally; among these are macros-
oma, the deceptively high station common in OP, or android pelvic features with the potential for dangerous outlet obstruction. Some should be delivered from the OP position without rotation, like with anthropoid pel-
vic features and ample room in the posterior pelvis. Even today, some should be rotated, whether manually or with forceps, and delivered from an anterior posi-
tion. Kielland forceps rotations still have a place in modern obstetrics. The challenges posed by a decreasing number of clinicians willing to perform or teach the procedure are substantial. Those of us trained in the procedure must be willing to perform them and teach them acknowledging that opportunities to do so may come at the most inopportune times. Simulation train-
ing offers promise and I hope that models and tech-
iques will get closer to the invaluable feedback gained when real rotations are and are not proceeding well. Lastly, I am of the firm opinion that we cannot con-
tinue to train all residents to be proficient in all proce-
dures. Training in complicated operative vaginal delivery should be limited to those who will be per-
forming such procedures after residency.

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