Operative vaginal delivery

Operative vaginal delivery

OVD refers to delivery in which the operator uses forceps, a vacuum, or other devices to extract the fetus from the vagina, with or without the assistance of maternal pushing.

The decision to use an instrument to deliver the fetus balances the maternal, fetal, and neonatal impact of the procedure against the alternative options of cesarean birth or expectant management.

INDICATIONS

Overview — Use of either forceps or vacuum is reasonable when an operative intervention to complete labor is indicated and operative vaginal delivery can be safely and readily accomplished; otherwise, cesarean delivery is the better option.

We agree with an American College of Obstetricians and Gynecologists (ACOG) practice bulletin that considers the following scenarios potentially appropriate reasons for operative vaginal delivery.

Maternal exhaustion and an inability to push effectively.

- Maternal medical indications, such as maternal cardiac disease and a need to avoid pushing in the second stage of labor.
- Prolonged second stage of labor.
- Suspicion of immediate or potential fetal compromise.

However, no indication is absolute, and cesarean delivery is also an option in these clinical settings.

Although one can never be certain of a successful outcome, we attempt an operative vaginal delivery when we believe success is likely since the rate of birth trauma may be higher after failed attempts at operative delivery [8,9]. The decision to proceed with operative vaginal delivery is an ongoing process with constant reconsideration based on assessment of the success of sequential steps in the procedure. Preprocedure risk factors do not accurately predict whether an operative vaginal delivery attempt will succeed or fail.

Prolonged second stage of labor — To reduce the rate of cesarean delivery for failure to progress in the second stage, ACOG and the Society for Maternal-Fetal Medicine recommend allowing three hours of pushing for nulliparous women and two hours of pushing for multiparous women before diagnosing arrest of labor, when maternal and fetal conditions permit [11].

They also opined that longer durations may be appropriate on an individual basis (eg, epidural anesthesia, fetal malposition) as long as progress is being documented but did not provide specific criteria for the upper limit of the second stage. Many obstetric providers allow an extra hour of pushing for women with epidural anesthesia when the fetal heart rate pattern is reassuring of fetal well-being. These criteria are also useful for deciding when to perform an operative vaginal delivery.

For patients whose second stage is prolonged by these criteria and who have a normal fetal heart tracing and no other indication for expediting delivery, we evaluate the relative value of an operative delivery versus expectant management. We favor expectant management when we believe a spontaneous delivery is likely because fetal descent is progressing, albeit slowly, or because there has been a recent favorable change in the clinical situation, such as rotation from occiput posterior to occiput anterior, oxytocin augmentation, or more effective pushing. We favor operative vaginal delivery when further progress seems unlikely, and we believe operative vaginal delivery is the least morbid operative strategy, given the fetal station, position, and estimated size. Many of these cases appear to be related to ineffective pushing due to maternal exhaustion or, less commonly, to a maternal neurologic or muscular disease. Women with a prolonged second stage who are not good candidates for operative vaginal delivery are delivered by cesarean.

Fetal compromise

Use of forceps or vacuum is appropriate when expeditious delivery is indicated because of fetal compromise or probably imminent fetal compromise (eg, acute abruption) and operative vaginal delivery can be safely and readily accomplished; otherwise, cesarean delivery is the better option.

Maternal medical disorder

Forceps or vacuum can be used to shorten the second stage of labor if the Valsalva maneuver is contraindicated or exertion should be minimized because of maternal medical disorders (typically cardiac or neurologic disease, also cystic lung disease). As discussed above, maternal neurologic or muscular disease can impair effective pushing and can be a reason to shorten the second stage. Operative intervention is performed when uterine contractions descend the fetus to a station where the clinician believes forceps or vacuum extraction can be performed safely and effectively.

CONTRAINDICATIONS

- Fetal demineralizing disease (eg, osteogenesis imperfecta). The safety of forceps or vacuum delivery has not been established in disorders that result in demineralization of the skull. There is a theoretic risk for intracranial bleeding, extracranial bleeding, and other brain injuries due to cranial deformation or fracture from these instruments.

- Fetal bleeding diathesis (eg, fetal hemophilia, neonatal alloimmune thrombocytopenia [13]).

- Unengaged head. (The head is engaged when the widest diameter [the biparietal diameter] has reached or passed through the pelvic inlet. This typically occurs when the leading bony part has reached or passed through the ischial spines).

- Unknown fetal position.

- Brow or face presentation.

Relative contraindications to vacuum extraction

Relative contraindications to use of vacuum devices, but not forceps, include gestational age <34 weeks or prior scalp sampling (which is rarely performed in contemporary United States practice).

CLASSIFICATION

The American College of Obstetricians and Gynecologists' classification system for forceps deliveries is based on station and extent of rotation, as these factors correlate with the level of difficulty and procedure-related risk (eg, lower fetal station and smaller degree of head rotation are associated with less risk of maternal and fetal injury.

Fetal station is measured using the -5 to +5 centimeter classification system.

Outlet forceps

- The leading point of the fetal skull has reached the pelvic floor, and at or on the perineum, the scalp is visible at the introitus without separating the labia.
- The sagittal suture is in anteroposterior diameter or a right or left occiput anterior or posterior position.
- Rotation does not exceed 45 degrees.

Low forceps

•The leading point of the fetal skull is ≥2 cm beyond the ischial spines but not on the pelvic floor (ie, station is at least +2/5 cm).

•Low forceps have two categories that are based on whether rotation of the head is more or less than 45 degrees from the median sagittal plane:

-Without rotation – Rotation is 45 degrees or less (right or left occiput anterior to occiput anterior, or right or left occiput posterior to occiput posterior).

-With rotation – Rotation is greater than 45 degrees.

PREREQUISITES

he operator should be experienced in operative vaginal delivery and responsible for determining that the following prerequisites are met prior to application of instruments:

●Cervix is fully dilated.

●Membranes are ruptured.

●Head is engaged (at least 0/5 cm station). Forceps should never be used when the head is not engaged.

●Fetal presentation, position, station, and any asynclitism are known, and extent of molding is estimated. The fetus must be in a cephalic presentation (unless the purpose is to use Piper forceps to assist in delivery of an after-coming head in a breech presentation).

Large infants, extreme molding, extension of the fetal head, pelvic deformities, and asynclitism may falsely suggest engagement. In these cases, the leading bony part is at the ischial spines, although the biparietal diameter has not passed through the pelvic inlet. No more than one-fifth of the fetal head should be palpable abdominally above the symphysis pubis if the vertex is engaged

The patient has adequate anesthesia for the planned procedure.

The maternal bladder is empty, as this may provide more room for fetal descent and possibly reduce injury to the bladder.

Upper threshold

We believe that estimated fetal weight is one of several factors to assess when considering operative delivery of a suspected macrosomic infant. Multiple maternal factors (eg, diabetes, body mass index [BMI], prior infant size in successful vaginal deliveries, clinical pelvimetry, progress in the second stage) and fetal factors (eg, head position and station, caput and molding, estimated abdominal circumference compared with head circumference) can influence the decision to attempt an operative delivery.

In general, patients with severe obesity (defined as a BMI >40 kg/m^2), diabetes, slow progress in the second stage of labor with significant caput/molding, or an infant estimated to be over 4000 grams are not ideal candidates for operative vaginal delivery, but these cases must be individualized. An example of a case with estimated fetal weight 4000 grams where we would consider operative vaginal delivery might be a patient with fetal compromise at +3 station who has a normal BMI, no gestational or other diabetes mellitus, and a history of a prior spontaneous vaginal delivery of an infant of similar size

Upper threshold

The American College of Obstetricians and Gynecologists practice bulletin on operative delivery suggests that judicious use of forceps or vacuum extraction is not contraindicated for most fetuses suspected to be macrosomic, if the maternal pelvis and progress of labor are adequate [7]. However, the obstetrician should be aware of the risk of shoulder dystocia, especially when the second stage of labor is prolonged.

Lower threshold

Use of vacuum devices is limited to deliveries ≥34 weeks of gestation because the risk of intraventricular hemorrhage appears to be increased above baseline when these devices are employed at earlier gestational ages.

"Baby" Elliot and "baby" Simpson forceps have smaller dimensions than standard forceps and have been used to deliver fetuses as small as 1000 grams [18]. We were unable to identify any studies or manufacturer guidelines regarding prerequisites for estimated fetal weight or gestational age for use of these instruments. When clinically indicated, we would generally consider using forceps for fetuses estimated to weigh at least 2000 grams. We apply standard forceps if the head size is near or at the size of a term infant, and baby forceps for smaller heads.

Lower threshold

– Use of vacuum devices is limited to deliveries ≥34 weeks of gestation because the risk of intraventricular hemorrhage appears to be increased above baseline when these devices are employed at earlier gestational ages.

"Baby" Elliot and "baby" Simpson forceps have smaller dimensions than standard forceps and have been used to deliver fetuses as small as 1000 grams [18]. We were unable to identify any studies or manufacturer guidelines regarding prerequisites for estimated fetal weight or gestational age for use of these instruments. When clinically indicated, we would generally consider using forceps for fetuses estimated to weigh at least 2000 grams. We apply standard forceps if the head size is near or at the size of a term infant, and baby forceps for smaller heads.

PATIENT PREPARATION

Anesthesia — Before beginning an operative vaginal delivery, maternal anesthesia should be satisfactory. Neuraxial anesthesia provides more effective analgesia than pudendal block and is the only effective regional option for forceps delivery .

Pudendal block may be adequate for vacuum extraction because, unlike forceps blades, the vacuum cup does not significantly displace the walls of the birth canal or increase the cephalic diameter.

Ancillary procedures

Ultrasound — We often use ultrasound to determine fetal position and station before operative vaginal delivery to confirm our diagnosis from physical examination and to assess its chances of success as well as its risks. We always perform an ultrasound examination when we are uncertain of the head position.

Intrapartum sonographic visualization of fetal intracranial structures, including the cerebellum, orbits, and midline falx, can be used to determine fetal head position and station and may reduce morbidity of improperly placed instruments at the time of an operative vaginal delivery [20,21]. Multiple studies comparing ultrasound with digital vaginal examination of head position have shown digital examination is incorrect in approximately 20 to 40 percent of cases, regardless of the experience of the person performing the examination, whereas ultrasound is incorrect in only 1 to 2 percent of cases [20-22]. Ultrasound measurements of fetal station using perineum to skull distance or angle of progression appear to be reproducible, can diagnose lack of engagement, and are predictive of difficult operative vaginal deliveries [23]. In a prospective study, angle of progression and head circumference measurements done just prior to operative delivery were 87 percent predictive of more complicated deliveries (ie, ≥3 pulls and/or significant maternal or neonatal morbidity) [24].

Use of ultrasound to determine fetal position during late labor when cervical dilation is ≥8 cm may have unanticipated consequences. In a randomized trial comparing digital examination versus both ultrasound and digital examination at ≥8 cm dilation, occiput posterior and occiput transverse positions were under-detected on digital examination alone and knowing correct fetal position actually increased the likelihood of cesarean delivery [25].

Antibiotics

— Prophylactic antibiotics are not routinely administered before operative vaginal delivery because unnecessarily exposing mothers and fetuses to antibiotics has potential adverse effects (eg, emergence of antimicrobial resistance, selection of pathogenic organisms such as *Clostridioides* [formerly *Clostridium*] *difficile*, and drug toxicity). However, a trial of 3427 women randomized to a single dose of intravenous co-amoxiclav versus placebo as soon as possible after any operative vaginal delivery reported that the intervention resulted in a 42 percent reduction in suspected or confirmed infection in the six-week postpartum period (11 versus 19 percent, relative risk [RR] 0.58, 95% CI 0.49-0.69) [26]. The primary outcome was defined by a new prescription of antibiotics for presumed perineal wound-related infection, endometritis or uterine infection, urinary tract infection with systemic features or other systemic infection, or confirmed systemic infection on culture.

Importantly, the secondary outcomes of superficial and deep incisional infections were both reduced in the antibiotic group (4 versus 8 percent [RR 0.53, 95% CI 0.37-0.75] and 2 versus 5 percent [RR 0.46, 95% CI 0.28-0.77]). This appeared to translate into less perineal discomfort and less need for additional at-home or in-office perineal evaluation and care.

Antibiotics

Some factors that limit the generalizability of this trial to United States and other populations include higher rate of operative vaginal delivery in the United Kingdom than the United States (13 versus 3 percent [1]), higher episiotomy rate (89 versus 8 percent [27]), higher proportion of forceps use (2/3 versus 1/5 operative vaginal deliveries performed [1]), and the different approach to group B streptococcus (GBS) chemoprophylaxis (risk-based rather than culture-based). Other limitations of the trial are the higher observed than expected rate of infection in the placebo group (19 versus 10 percent) and a change in an outcome metric during the trial from "any antibiotics" to "antibiotics only for the indication of perineal infection." The finding that antibiotics administered at a median time of 3.2 hours after birth were effective is also surprising since tissue concentrations would not be optimal at the time of the procedure and repair.

Therefore, we believe additional trials are needed to confirm a benefit in other populations before recommending prophylactic antibiotics for all women who undergo an operative vaginal delivery. A 2020 systematic review [28] found only one additional trial [29], which was small (394 participants) and only evaluated the incidence of postpartum endometritis. Until such data are available, when an operative vaginal delivery is performed with an episiotomy, we believe it is reasonable to administer a single dose of intravenous co-amoxiclav immediately after the delivery, given that most of the patients in this trial had an episiotomy.

We routinely administer prophylactic antibiotics before repairing a third- or fourth-degree laceration. The American College of Obstetricians and Gynecologists recommends a single dose of prophylactic antibiotics at the time of repair of obstetric anal sphincter injuries, regardless of mode of delivery [30].

Episiotomy

We do not routinely perform an episiotomy. The only randomized trial comparing routine versus restrictive episiotomy at operative vaginal delivery found no significant differences between groups in the rate of anal sphincter tear, postpartum hemorrhage, neonatal trauma, or pelvic floor symptoms until 10 days postpartum; however, this was a pilot study with only 200 participants (the type of episiotomy was not described, but mediolateral episiotomy is preferred in Europe, where the trial was performed) [31].

Observational studies suggest that a median (or midline) episiotomy increases, rather than decreases, the risk of perineal trauma in operative vaginal deliveries [32-37]. Some population-based observational studies suggest that a mediolateral episiotomy performed in certain situations may reduce anal sphincter lacerations, specifically with forceps deliveries in women who have no history of prior vaginal deliveries or when there is persistent occiput posterior presentation [37,38]. As these observational data may have inherent biases, episiotomy should be performed selectively and with shared patient decision making. If performed, a mediolateral or lateral episiotomy appears preferable as it reduces the number of apparent anal sphincter injuries [38,39], although initial postpartum discomfort is greater than with a median/midline incision and early complaints of flatal incontinence are common (9 percent)

CHOICE OF INSTRUMENT

Both forceps and vacuum are acceptable instruments for operative vaginal delivery. Our approach depends on patient-specific factors, as described below.

When to choose vacuum versus forceps — We choose vacuum extraction when a relatively easy extraction is anticipated (eg, occipito-anterior position with no signs of relative cephalopelvic disproportion). Because success is likely, the primary consideration in these cases is to minimize the risk of maternal and fetal injury. If a difficult extraction is anticipated, we choose forceps despite a slightly higher risk of maternal injury because vacuum extraction is likely to fail [45].

The choice of instrument is determined by the clinician's expertise with the various forceps and vacuum devices, availability of the instrument, level of maternal anesthesia, and knowledge of the risks and benefits associated with each instrument in various clinical settings. Vacuum delivery is generally less traumatic for the mother than forceps delivery. Vacuum devices are easier to apply and require less maternal anesthesia than forceps. Fetal head rotation may occur passively during fetal extraction. The advantages of forceps are that they have a significantly higher success rate, are unlikely to detach from the head during a difficult extraction, can be used on premature fetuses or to actively rotate the fetal head, and do not aggravate bleeding from scalp lacerations. It is not clear which procedure is safer for the fetus; the complication profiles for the two procedures are different

Choice of vacuum cup

All vacuum extraction devices consist of a soft or rigid plastic cup, a vacuum pump to provide suction between the cup and fetal scalp, and a traction system. A soft vacuum cup is appropriate for most deliveries. Rigid cups may be preferable for occiput posterior, occiput transverse, and difficult occiput anterior deliveries because they are less likely to detach. A more detailed discussion regarding the choice of an extractor cup can be found separately.

Choice of forceps

The type of forceps selected for a particular procedure depends on several factors, including:

●The size and shape of the fetal head and maternal pelvis, which should match the size, cephalic curve, and pelvic curve of the forceps. A good head application is a key goal in choice of forceps.

•Simpson type forceps, which have long tapered blades, tend to be the best fit for a molded head because of the less concave cephalic curve.

Elliott type forceps (picture 2) or Tucker-McLane type forceps (picture 3) are better suited to a round, unmolded head as the cephalic curve of the forceps is more concave.

picture 2

picture 3

Fenestrated blades (picture 4) allow for a better grip and therefore are less likely to slip, but the fenestrations increase the risk for tissue laceration when greater forces are applied. Solid blades (picture 3) are less likely to lacerate the fetal head but may be more likely to slip with increased traction. Pseudo fenestrated blades have a shallow indentation rather than a true fenestrated, which may reduce slippage while also reducing risks of laceration.

picture 4

Picture 3

Fetal head position and whether rotation is planned. Choosing the right forceps for the direction of traction and type of rotation is another key goal.

•Kielland forceps are useful for rotations because of their minimal pelvic curve and sliding lock (picture 4). A sliding lock is helpful when there is asynclitism.

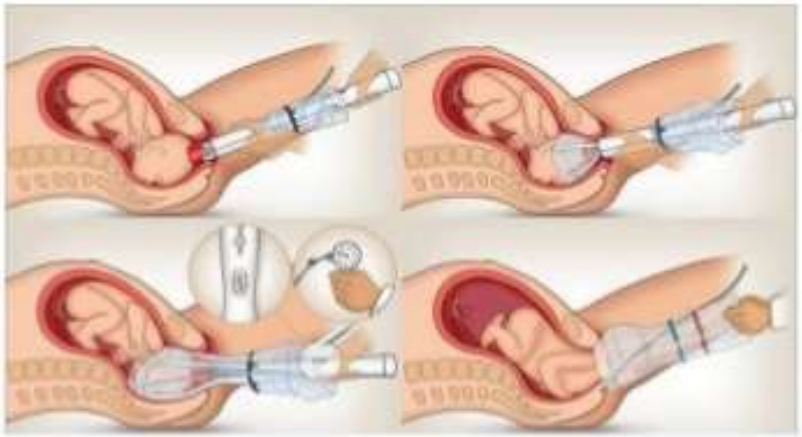
•Piper forceps are used to deliver the aftercoming head in vaginal breech deliveries (picture 5).

Novel devices

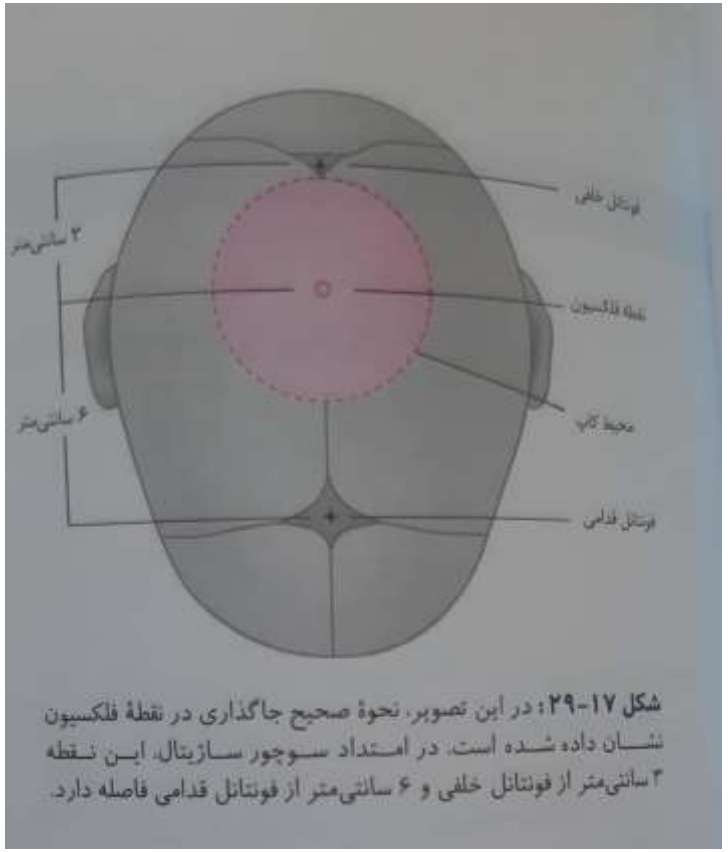
Novel devices

- Thierry or Teissier spatula

- Odon device

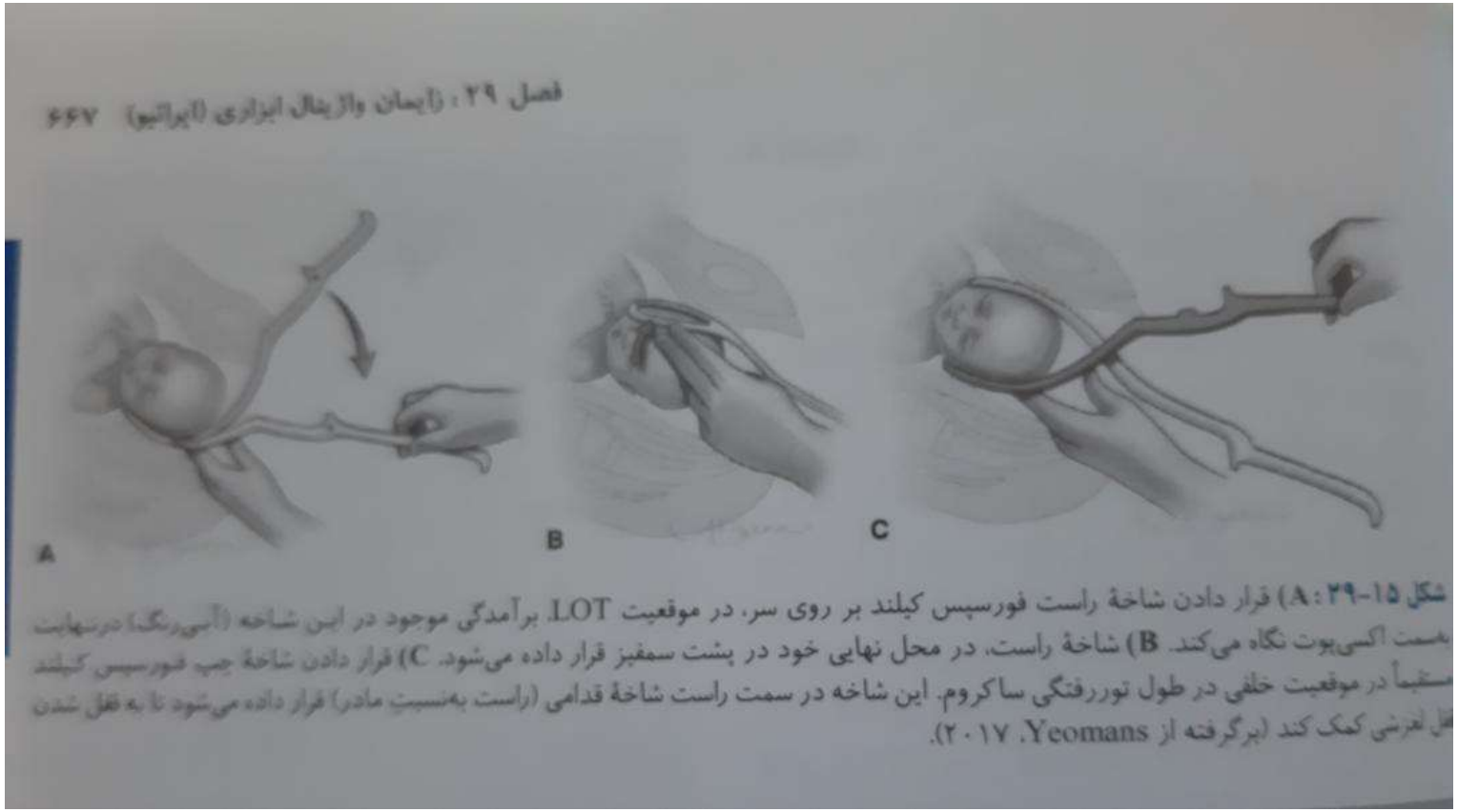


نحوه صحیح جاگذاری واکیوم



شکل ۱۷-۲۹: در این تصویر، نحوهٔ صحیح جاگذاری در نقطهٔ فلکسیون نشان داده شده است. در امتداد سوچور ساژیتال، این نقطه ۳ سانتی‌متر از فونتانل خلفی و ۶ سانتی‌متر از فونتانل قدامی فاصله دارد.

نحوه جاگذاری فورسپس



فصل ۲۹ : زایمان واژینال ابزاری (اپرانیو) ۶۶۷

A B C

شکل ۱۵-۲۹: A) قرار دادن شاخهٔ راست فورسپس کیلند بر روی سر، در موقعیت LOT. برآمدگی موجود در این شاخه (آبی‌رنگ) درنهایت به‌سمت اکسی‌پوت نگاه می‌کند. B) شاخهٔ راست، در محل نهایی خود در پشت سمفیز قرار داده می‌شود. C) قرار دادن شاخهٔ چپ فورسپس کیلند مستقیماً در موقعیت خلفی در طول تورفتگی ساکروم. این شاخه در سمت راست شاخهٔ قدامی (راست به‌نسبت مادر) قرار داده می‌شود تا به نقل شدن نقل لغزشی کمک کند (برگرفته از Yeomans، ۲۰۱۷).

PROCEDURE

Forceps

- **Application** – Appropriately applied forceps grasp the occiput anterior (OA) fetal head such that:
- The long axis of the blades corresponds to the occipitomental diameter (figure 2).
- The tips of the blades lie over the cheeks (figure 3).
- The blades are equidistant from the sagittal suture, which should bisect a horizontal plane through the shanks.
- The posterior fontanelle should be one finger breadth anterior to this plane.
- Fenestrated blades should admit no more than one finger breadth between the heel of the fenestration and the fetal head.
- No maternal tissue has been grasped.

When to abandon the procedure

The operator should not be fixated on achieving a vaginal delivery. It is essential that the operator be willing to abandon a planned or attempted operative delivery and have the ability to perform a cesarean birth if evaluation or reevaluation of the clinical status shows that an instrumental delivery is contraindicated (eg, the fetal head is not engaged, the position is uncertain, the procedure is not succeeding).

The most common and highest risk clinical factors associated with failed operative vaginal delivery are occiput posterior position, macrosomia, prolonged second stage, primiparity, and maternal obesity [8,58-65]. Other characteristics that have been associated with failure include higher station and excessive molding of the fetal head.

Maternal and newborn examination

— The lower genital tract, peritoneum, and anus/rectum should be examined after delivery for lacerations. It is important to remember to perform this examination in women who undergo cesarean delivery after a failed attempt at operative delivery.

The neonatal care provider should be informed that vacuum or forceps were used to assist delivery. Since most serious complications, such as a subgaleal hematoma, occur within hours of delivery [73], it is important to inform infant care providers by either a reliable charting method, direct notification, or both.

SUCCESS RATE

failed delivery occurred in :

9 percent of forceps deliveries

14 percent of vacuum deliveries

Midforceps delivery is more likely to fail than low forceps delivery; failure rates were 8.9 and 0.3 percent, respectively, in one large prospective study.

Historically, failed forceps was more likely to lead to cesarean delivery than failed vacuum since failed vacuum extraction was sometimes followed by a successful trial of forceps, but the converse rarely occurs. As sequential use of instruments carries much higher morbidities, it is no longer considered acceptable to perform sequential instrument use.

COMPLICATIONS

Overview — Maternal and fetal/neonatal complication rates vary widely in published series and depend on a number of factors, which are not independent. These factors include type of instrument, head position at application, station, indication for intervention, and operator experience. Rotation, higher station, longer active second stage of labor, and operator inexperience variably increase the risk of complications. However, complications can occur even when instruments are correctly applied and used. Virtually all complications associated with operative vaginal delivery can also occur in the course of a spontaneous vaginal delivery, but the incidence is lower in the latter.

COMPLICATIONS

Birth trauma is the major potential complication of operative vaginal delivery. A population-based analysis of over 11 million singleton births in the United States provided crude comparative morbidity/mortality data for unassisted (spontaneous), forceps-assisted, and vacuum-assisted births (table 3) [76]. Although based on far fewer births, state-based data for California and New Jersey provide a more detailed description of the specific types of injuries associated with different instruments and modes of delivery (table 4 and table 5 and table 6) [66,76]. These data should be interpreted with respect to appropriate control groups and reasonable alternative procedures. For example, second stage cesarean delivery is an alternative to operative vaginal delivery, but prelabor cesarean delivery and spontaneous vaginal delivery are not realistic alternatives in the setting of second stage labor complications. Bias in patient selection is also an important factor; the vacuum approach is often favored over forceps in patients most likely to delivery readily. When considering the morbidity of operative vaginal versus cesarean delivery, it should be noted that, when dystocia is the indication, forceps and vacuum deliveries were associated with higher rates of perinatal morbidity and mortality than cesarean deliveries performed in the second stage

Neonatal complications

Vacuum-assisted deliveries — Torsion and traction by the vacuum cup can cause life-threatening complications following use of vacuum-assisted devices [78]. These complications include intracranial hemorrhage (epidural, subdural, intraparenchymal, subarachnoid), intraventricular hemorrhage, and subgaleal hemorrhage (figure 4). (See "Neonatal birth injuries".)

Other potential complications include fetal scalp abrasions and lacerations, cephalohematoma, retinal hemorrhage, and brachial plexus injury [45,66,79-82]. In a prospective study of retinal hemorrhage in healthy newborns, the incidence was higher for vacuum-assisted than for spontaneous vaginal or cesarean deliveries (75, 33, and 7 percent, respectively) [83]. The hemorrhages typically resolved without sequelae within four weeks of birth. Cephalohematoma was almost twice as common after vacuum-assisted extraction than forceps delivery (9.4 versus 5.2 percent) in a systematic review, but the difference was not statistically significant [45]. The majority of cephalohematomas resolve spontaneously over the course of a few weeks without any intervention. Shoulder dystocia is more common with vacuum-assisted than forceps deliveries [76,84]. For this reason, vacuum-assisted deliveries are at higher risk of brachial plexus injury than forceps-assisted deliveries or cesarean delivery

Neonatal complications

Forceps-assisted deliveries — Complications of forceps delivery include skin markings and lacerations, external ocular trauma, intracranial hemorrhage, subgaleal hemorrhage, retinal hemorrhage, lipoid necrosis, facial nerve injury, skull fracture, and, rarely, death [12,66,85,86]. Facial palsies [82,86], other facial injuries, and depressed skull fractures [86] are more common with use of forceps than vacuum devices. In a meta-analysis of randomized trials, facial injury was fivefold more likely with forceps than vacuum

Maternal complications

— Maternal complications associated with operative vaginal delivery include lower genital tract laceration, vulvar and vaginal hematomas, urinary tract injury, and anal sphincter injury [87-96]. Occiput posterior position is a risk factor for maternal trauma during operative vaginal delivery [97-99], particularly third-/fourth-degree perineal lacerations (spontaneous delivery 2 percent, vacuum extraction 10 to 11 percent, forceps delivery 17 to 20 percent [94,100]).

Increasingly complex operative intervention is associated with increasing maternal morbidity such that spontaneous vaginal delivery is least morbid, followed by vacuum extraction, then forceps delivery, and lastly cesarean delivery, where venous thromboembolism, endometritis, and wound infection are particular concerns. Although cesarean delivery protects the genital tract from forceps/vacuum-related trauma, the long-term risk of urinary incontinence, anal incontinence, and prolapse symptoms was not lower with second stage cesarean delivery compared with operative vaginal delivery in longitudinal cohort studies

Vacuum-assisted deliveries

— Randomized trials generally report less maternal genital trauma with vacuum versus forceps extraction (refer to data below), which is not unexpected given that a correctly applied vacuum cup does not take up additional space between the fetal head and the birth canal and does not make contact with maternal soft tissue [45].

This difference has not been proven to impact long-term maternal outcomes, such as urinary and anal dysfunction and pelvic organ prolapse. In a trial that randomly assigned 75 women to forceps or vacuum delivery and then surveyed them five years postpartum, long-term morbidity rates were similar for both instruments; 47 percent had some degree of urinary incontinence and 20 percent had loss of bowel control "sometimes" or "frequently" [103]. This trial was limited by the small number of subjects.

Vacuum deliveries have been associated with lower rates of maternal morbidity and mortality than cesarean delivery in the second stage